ADDENDUM 3 (PENDING DSA APPROVAL)

HAMMEL, GREEN AND ABRAHAMSON, INC.,
ARCHITECTS & ENGINEERS
1918 Main Street, Third Floor
Santa Monica, CA 90405

PROJECT: **Santa Ana College**
Science Center

DATE: 9/22/2017

OWNER: **RSCCD**
2323 N. Broadway, Suite 112
Santa Ana, CA 92706

DSA File No.: 30-C2
DSA Applications No.: 04-115788
HGA Commission No.: 3584-001-00

CONSTRUCTION MANAGER:

BERNARDS
3633 E. Inland Empire Blvd., Suite 800
Ontario, CA 91764

The additions, revisions, omissions, corrections and clarifications contained herein shall be made to drawings and specifications for the project and shall be included in scope of work and bids to be submitted. Additionally, reference documents, such as as-built documentation of existing buildings, are provided to further quantify the scope of work. References made below to specifications, drawings, and other documents shall be used as a general guide only. Bidders and Contractors shall determine for themselves the work affected by Addendum items.

RFP

None

SPECIFICATIONS (All revisions to the specification are noted in underline or ~~strikeout~~ with the corresponding addendum reference "ADD-3")

Item AD-3-1: Revise 000110 TABLE OF CONTENTS
Item AD-3-2: Revise SECTION 012100
Item AD-3-3: Add SECTION 012300
Item AD-3-4: Revise SECTION 017836
Item AD-3-5: Revise SECTION 018113.13
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Item AD-3-50: Revise SECTION 272000
Item AD-3-51: Revise SECTION 274116
Item AD-3-52: Revise SECTION 282300
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Item AD-3-57: Revise SECTION 328400
Item AD-3-58: Revise SECTION 329000
Item AD-3-59: Revise SECTION 329700

DRAWINGS

CIVIL:

Item AD-3-60: Revise C0.01

- Added new sheets C1.53, C1.54, C1.54, C1.55 and C5.03 to sheet index.

Item AD-3-61: Revise C1.10

- Added call outs for additional site features such as sewer manholes and utility vaults that were constructed after the project survey.

Item AD-3-62: Revise C1.31

- Added note for contractor to verify existing CMU wall top of wall, top of footing, and bottom of footing elevations.
- Dropped the new CMU wall footing to meet minimum cover requirement per structural.

Item AD-3-63: Revise C1.33

- Added existing utility vault cover locations to be adjusted to grade.

Item AD-3-64: Revise C1.34

- Added existing utility vault cover locations to be adjusted to grade. Added note for contractor to verify existing top of wall elevation to join.

Item AD-3-65: Revise C1.35

- Revised grading at the ADA parking entrance.

Item AD-3-66: Revise C1.40

- Updated storm drain alignment.
- Added 60-inch perforated pipe and pretreatment structure.
- Revised storm drain pipe sizes.
- Added footing drain to the west site CMU wall.

Item AD-3-67: Revise C1.50

- Coordinated communication line connection to building. Clarified utility construction notes.

Item AD-3-68: Revise C1.51

- Updated plan to reflect existing hydronic/gas vault location and revised routing of hydronic and gas lines to building. Clarified utility construction notes.

Item AD-3-69: Add C1.52

- Revised sheet to be storm drain profiles

Item AD-3-70: Add C1.53

- New sheet for storm drain profiles

Item AD-3-71: Add C1.54

- New sheet for sewer profile and utility sections

Item AD-3-72: Add C1.55

- New sheet for utility sections

Item AD-3-73: Revise C1.60

- Extended the curb up to the truncated domes in southeast entrance.
- Added parallel parking stalls with stripping, new-valley gutter, and heavy traffic rated asphalt in required areas.

Item AD-3-74: Revise C1.70

- Revised locations of fire lane signs per Signage Plan.

Item AD-3-75: Revise C5.02

- Removed Detail 7, “LEV SIGN PANEL” and replaced with “Parallel Parking Stall Detail.”
- Added Detail 10, 3” perforated pipe detail.
- Added note to detail 9 to allow for precast catch basin alternative for the stormdrain overflow structure.

Item AD-3-76: Revise C5.03

- Added detail 1 for crosswalk striping, detail 2 for temporary stormwater pretreatment structure, and detail 3 for footing drain with continuous perforated drain.

ARCHITECTURAL:

Item AD-3-77: Revise A011

- Material ID were clarified or removed from project.

Item AD-3-78: Revise A024

- Clarified notes in Fireproofing Legend
- Detail 3: Removed hatch in elevator shaft.

Item AD-3-79: Revise A061

- Curb at ADA parking stall extended.

Item AD-3-80: Revise A062

- Detail 1: Detail callout added.

Item AD-3-81: Revise A063

- Detail 2: Detail callout added; Material ID added; gutter location updated
- Detail 3: Detail callout added; Material ID added; modified fencing spacing.
- Detail 6, 7, 8, 9: Clarified material ID for Stainless Steel Shelf
- Gutter updated, typ.

Item AD-3-82: Revise A065

- Detail 1: Updated note regarding concrete slab to coordinate with structural drawings
- Detail 2: Updated gate to match <GATE-1> basis of design specs.
- Detail 4: Added material ID tag; detail updated to match <GATE-1> basis of design specs
- Detail 5: Detail clarified.
- Detail 6: Updated note
- Deleted Detail 8.
- Added Detail 10 and 11.

Item AD-3-83: Revise A066

- Detail 1: Dimension added for temporary construction barrier
- Detail 4: dimensions for equipment pad added; Material ID tag updated.

Item AD-3-84: Revise A067

- Detail 1: Added <MET FAB-10> at gate
- Detail 7 and 8 added.

Item AD-3-85: Revise A080

- Detail 3: Updated Gate type; Clarified glass on the first level

Item AD-3-86: Revise A082

- Added note 6-9.
- Updated Frame and Door finishes.
- Updated Door types.

Item AD-3-87: Revise A090

- “AWT-X” changed to “AWP-X”.
- Added note regarding plywood

Item AD-3-88: Revise A201

- Interior elevation views added.
- <MBR-3> tag updated to be <MBR-1> typ.
- Elevator shaft increased.
- Wall tags added.
- Added NOTE O and P

Item AD-3-89: Revise A202

- Elevator shaft increased.
- Wall tags added
- Added Wall phone in SC220
- OFCI equipment added

- Note 11 added
- Moved wall phone in SC215
- Added NOTE O and P

Item AD-3-90: Revise A203

- Elevator shaft increased.
- Wall tags added
- OFCI equipment added
- Keynote 11 added
- Note added to provide Desk Phone in SC318
- Added NOTE O and P

Item AD-3-91: Revise A211

- Extent of slab depression updated.
- Added and modified location of floor box inside Science Learning Center

Item AD-3-92: Revise A212

- Extent of slab depression updated.

Item AD-3-93: Revise A213

- Extent of slab depression updated.

Item AD-3-94: Revise A214

- 6" curb shown at Stair #1 landing.

Item AD-3-95: Revise A221

- General note added for typical wall colors.
- Note C updated.

Item AD-3-96: Revise A301

- <WRT-2> revised to be <PLTR-1> at exterior plaster conditions.
- Legend updated

Item AD-3-97: Revise A400

- Detail 1: Updated Material ID tags.
- Detail 1: Updated reference call out.
- Detail 1: Window tags updated.

Item AD-3-98: Revise A401

- Detail 1: Updated Material.
- Detail 2: Updated note.
- Detail 3: Material tags updated.

Item AD-3-99: Revise A431

- Detail 1: Updated material ID tag
- Detail 5: Revised detail

Item AD-3-100: Revise A432

- Updated material ID tag at roof to be <GYP SHTG-4>
- Detail 5: Added reference at drain

Item AD-3-101: Revise A434

- Detail 4: <GYP SHTG-6> revised to be <GYP SHT-2>

Item AD-3-102: Revise A435

- Detail 1: Reference updated.
- Detail 4, 7: Updated tag to be <MBR-1>

Item AD-3-103: Revise A443

- Update AFS-3 tag to CW-3.

Item AD-3-104: Revise A444

- Detail 1: Updated detail
- Detail 5: Revised attachment
- Added Detail 6

Item AD-3-105: Revise A445

- Updated material ID tag at roof to be <GYP SHTG-4>

Item AD-3-106: Revise A450

- Removed MP2 and MS2 wall types.

Item AD-3-107: Revise A451

- Update AFS-3 tag to CW-3.

Item AD-3-108: Revise A455

- Detail 1: Eliminated alcove.
- Detail 2, 3: Clarify the gas pressure regulator & seismic valve

Item AD-3-109: Revise A464

- Detail 1: Updated tag to be <MBR-1>.

Item AD-3-110: Add A474

- Added sheet for Mural Alternate #5.

Item AD-3-111: Revise A480

- Detail 12: No <MBR-2>; Added material ID for sheathing

Item AD-3-112: Revise A481

- Detail 2: No <SPA-2>; Revised detail get rid of cover board
- Removed detail 3.

Item AD-3-113: Revise A490

- Material ID tags updated
- Notes added.
- Detail 26 and 27 added.

Item AD-3-114: Revise A491

- Detail 1: Added Material ID tag
- Detail 2: Revised Material ID tag
- Detail 3: Revised Material ID tag
- Detail 4,5: Revised Material ID tag
- Detail 6: Added Material ID tag
- Detail 7: Added Material ID tag
- Detail 9: Added Material ID tag
- Detail 10: Revised Material ID tag

Item AD-3-115: Revise A501

- Detail references added, typ.
- Material ID tags updated, typ.

Item AD-3-116: Revise A502

- Detail references added, typ.
- Material ID tags updated, typ.

Item AD-3-117: Revise A503

- Detail references added, typ.
- Material ID tags updated, typ.

Item AD-3-118: Revise A520

- Detail 1: Elevator shaft increased and associated dimensions updated.
- Detail 2,3: Add waterproofing at elevator pit

Item AD-3-119: Revise A560

- Detail 3: Detail updated to be consistent with Structural.
- Detail 4, 8, 9: Notes updated.

Item AD-3-120: Revise A561

- Removed detail 4 & 5.
- Detail 1, 2, 3: Notes updated.

Item AD-3-121: Revise A562

- Detail 1: Clarified dimension
- Detail 4: Notes updated; Detail updated to be consistent with Structural
- Detail 7: Detail updated to be consistent with Structural
- Detail 8 updated

Item AD-3-122: Revise A563

- Detail 1 and 2: handrail return to guardrail
- Detail 6: reference updated

Item AD-3-123: Revise A601

- Detail 1: Updated Material ID tags.
- Detail 4: Updated Material ID tag.

Item AD-3-124: Revise A603

- Detail 4: Updated Material ID tags.
- Added Detail 5, 6, 7

Item AD-3-125: Revise A604

- Detail 1: Updated Material ID tags.
- Detail 2: Updated Material ID tags.
- Detail 4: Updated Material ID tags.

Item AD-3-126: Revise A605

- Detail 6: Updated Material ID tags.
- Detail 8: Updated Material ID tags.

Item AD-3-127: Revise A606

- Detail 1: Updated Material ID tags.
- Detail 2: Updated Material ID tags.
- Detail 4: Updated Material ID tags.

Item AD-3-128: Revise A620

- Detail 3: Detail callout added.
- Detail 9: Detail callout added.

Item AD-3-129: Revise A621

- Detail 3: Detail callout added.
- Detail 9: Detail callout added.

Item AD-3-130: Revise A622

- Detail 3: Detail callout added.
- Detail 9: Detail callout added.

Item AD-3-131: Revise A624

- Detail 1: Lectern shown per AV

Item AD-3-132: Revise A625

- Detail 2: Interior elevation views added; shelve added.

Item AD-3-133: Revise A630

- Updated material ID tags

Item AD-3-134: Revise A660

- Remove note N and O, not used.

Item AD-3-135: Revise A667

- Detail 14: Added notes

Item AD-3-136: Revise A680

- Detail 1: Removed Material ID tag.
- Detail 5: Updated Material ID tag.
- Detail 6: Updated Material ID tag.
- Detail 7: Updated Material ID tag.
- Detail 8: Updated Material ID tag.

- Detail 14: Updated Material ID tag.

Item AD-3-137: Revise A682
- Detail 2, 3, 5, 6, 7, 9, 10, 11, 15, 16: Updated Material ID tag.

Item AD-3-138: Revise A683
- Detail 2, 3, 4, 5, 6: Updated Material ID tag.

Item AD-3-139: Revise A684
- Updated Material ID tag on all details.

Item AD-3-140: Revise A685
- Detail 1: Updated Material ID tag.
- Detail 2: Updated Material ID tag.
- Detail 4: Updated Material ID tag; added dimensions.

Item AD-3-141: Revise A686
- Detail 1, 2, 3, 4: Updated Material ID tag.

SIGNAGE:

Item AD-3-142: Revise GS.04
- Missing Type 26 (Fire Riser Room) reference added to sign legend.

Item AD-3-143: Revise GS.06
- Sign color and/or material information provided, or updated.

Item AD-3-144: Revise GS.07
- Sign color and/or material information provided, or updated.

Item AD-3-145: Revise GS.08
- Sign color and/or material information provided, or updated.

Item AD-3-146: Revise GS.09
- Sign color and/or material information provided, or updated.

Item AD-3-147: Revise GS.10
- Sign color and/or material information provided, or updated.

Item AD-3-148: Revise GS.11
- Sign color and/or material information provided, or updated.
- A note was added to site signs that reads: “For anchorage details see architectural sheet A065”.

Item AD-3-149: Revise GS.12
- Sign color and/or material information provided, or updated.
- A note was added to site signs that reads: “For anchorage details see architectural sheet A065”.

Item AD-3-150: Revise GS.13
- Sign color and/or material information provided, or updated.
- A note was added to site signs that reads: “For anchorage details see architectural sheet A065”.

LAB FURNISHING

Item AD-3-151: Revise LF1.00
- Added keynote 24 for items furnished by the Owner and installed by the General Contractor.

Item AD-3-152: Revise LF2.01B
- Revised base cabinet tags in Geology/Physical Science Prep & Storage SC120 to match elevations.

Item AD-3-153: Revise LF2.02B
- Added keynote 24 to item to be furnished by Owner and installed by the General Contractor in Microbiology Lab SC216

Item AD-3-154: Revise LF2.02C
- Added keynote 24 to items to be furnished by Owner and installed by the General Contractor in Molecular Biology Prep & Storage SC214.

Item AD-3-155: Revise LF2.03B

- Added keynote 24 to item to be furnished by Owner and installed by the General Contractor in Centralized Prep & Storage SC322.

Item AD-3-156: Revise LF3.00

- Revised base cabinet elevations to match floor plan tags in elevation 4, 5, 6, 7.

Item AD-3-157: Revise LF3.04

- Revised base cabinet elevations to match floor plan tags in elevation 3.

STRUCTURAL

Item AD-3-158: Revise S2.08

- Detail 11 was added to clarify the top mural framing connection.
- Detail 11 was added and referenced on Details 1, 2, and 3.

Item AD-3-159: Add S2.08A

- New sheet added to show an alternate mural framing.
- Only the WT connection detail has been removed, as the architectural panel is directly connected to the HSS framing

Item AD-3-160: Revise S2.61

- Details A/S2.61 was revised.

Item AD-3-161: Revise S3.01

- Detail 1/S3.01 was revised.

Item AD-3-162: Revise S6.01

- Detail 1 updated.

Item AD-3-163: Revise S6.02

- Detail 1 updated.

MECHANICAL

Item AD-3-164: Revise M0.13

- Updated CAV-222 airflow to respond to BID RFI.

Item AD-3-165: Revise M2.01

- Revised airflows of a number of air valves to respond to BID RFIs.

Item AD-3-166: Revise M2.02

- Revised airflows of a number of air valves to respond to BID RFIs.

Item AD-3-167: Revise M2.03

- Revised airflows of a number of air valves to respond to BID RFIs.

Item AD-3-168: Revise M2.04

- Added lining (L) callout on SA and RA ductwork to match specification requirements and respond to BID RFI.

Item AD-3-169: Revise MP2.01

- Added pressure sensors.

Item AD-3-170: Revise MP2.02

- Added pressure sensors.

Item AD-3-171: Revise MP2.03

- Added pressure sensors.

PLUMBING

Item AD-3-172: Revise P0.02

- Revised fixture schedule to include garbage disposer model and changes to drinking fountain symbol

Item AD-3-173: Revise P1.11

- Revised Greenhouse water POC location and show site lab waste piping sizes

ELECTRICAL

Item AD-3-174: Revise E0.2A
- SINGLE LINE DIAGRAM, revise as indicated.

Item AD-3-175: Revise E0.2B
- SINGLE LINE DIAGRAM, revise as indicated.

Item AD-3-176: Revise E0.4
- ENLARGED ELECTRICAL AND TELECOM ROOMS, revise as indicated.

Item AD-3-177: Revise E0.6A
- DETAILS, revise as indicated.

Item AD-3-178: Revise E0.7
- Level 01 Panel Schedules, revise as indicated

Item AD-3-179: Revise E0.7A
- Level 01 Panel Schedules, revise as indicated

Item AD-3-180: Revise E0.7B
- Level 02 Panel Schedules, revise as indicated

Item AD-3-181: Revise E0.7C
- Level 02 Panel Schedules, revise as indicated

Item AD-3-182: Revise E0.7D
- Level 03 Panel Schedules, revise as indicated

Item AD-3-183: Revise E0.7E
- Level 03 Panel Schedules, revise as indicated

Item AD-3-184: Revise E0.7F
- ROOF PANEL SCHEDULES, revise as indicated.

Item AD-3-185: Revise E2.3
- MURAL AND STAIRWELL LIGHTING PLAN, revise as indicated.

Item AD-3-186: Revise E3.0
- LEVEL 01 POWER PLAN, revise as indicated.

Item AD-3-187: Revise E3.1
- LEVEL 02 POWER PLAN, revise as indicated.

Item AD-3-188: Revise E3.2
- LEVEL 03 POWER PLAN, revise as indicated.

Item AD-3-189: Revise E3.3
- ROOF ELECTRICAL PLAN, revise as indicated.

Item AD-3-190: Revise EF4.2
- LEVEL 01 FIRE ALARM PLAN, revise as indicated.

TELECOM

Item AD-3-191: Revise T1.0
- TELECOM SYMBOL LIST, NOTES & DETAILS, revise as indicated.

Item AD-3-192: Revise T1.5
- LEVEL 01 TELECOM PLAN, revise as indicated.

Item AD-3-193: Revise T1.5A
- LEVEL 01 ENLARGED TELECOM PLAN, revise as indicated.

Item AD-3-194: Revise T1.5B
- LEVEL 01 ENLARGED TELECOM PLAN, revise as indicated.

Item AD-3-195: Revise T1.6
- LEVEL 02 TELECOM PLAN, revise as indicated.

Item AD-3-196: Revise T1.6A

- LEVEL 02 ENLARGED TELECOM PLAN, revise as indicated.

Item AD-3-197: Revise T1.6B

- LEVEL 02 ENLARGED TELECOM PLAN, revise as indicated.

Item AD-3-198: Revise T1.6C

- LEVEL 02 ENLARGED TELECOM PLAN, revise as indicated.

Item AD-3-199: Revise T1.7

- LEVEL 03 TELECOM PLAN, revise as indicated.

Item AD-3-200: Revise T1.7A

- LEVEL 03 ENLARGED TELECOM PLAN, revise as indicated.

Item AD-3-201: Revise T1.7B

- LEVEL 03 ENLARGED TELECOM PLAN, revise as indicated.

Item AD-3-202: Revise T1.7C

- LEVEL 03 ENLARGED TELECOM PLAN, revise as indicated.

SECURITY

Item AD-3-203: Revise SE1.11

- Added detail callout for CR SC001A.
- Moved camera SC012.

Item AD-3-204: Revise SE2.01

- Added ID to elevator cameras SC202 and SC302.
- Added ID to exterior camera SC001.
- Corrected camera ID outside door 114B from SC103 to SC101.

Item AD-3-205: Revise SE2.02

- Removed elevator cameras.

Item AD-3-206: Revise SE4.01

- Updated detail B.

Item AD-3-207: Revise SE4.04

- Updated detail C.

Item AD-3-208: Revise SE5.01

- Updated device schedules.

FIRE PROTECTION

Item AD-3-209: Revise FP-001

- Revised General Note 43

DRAWINGS – AS-BUILT

None

RESPONSES TO PRE-BID CLARIFICATION ("PBC")

None

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END OF SECTION

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ALLOWANCES

Revised, Addendum #3, 9/22/2017

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements governing Contract allowances.

1. Allowances as set forth in the Contract Documents are to be used as compensation for items as set forth in this Section. The amounts listed in the Contract Documents are to be included in the base bid and shall be listed separately in the Schedule of Values and Application for Payment.

1.02 RELATED SECTIONS

A. Section 01 29 73: Schedule of Values Procedures.

B. Section 01 29 76: Progress Payment Procedures.

C. Section 01 32 13: Construction Schedule.

D. Section 01 50 00: Construction Facilities and Temporary Controls.

1.03 ALLOWANCES

A. Use the allowances only as authorized for Owner purposes and only by submitting a form that indicates the amounts to be charged to the respective allowance amount to the District Representative.

B. District Representative and Architect will review Contractor's basis for its use of any Allowance costs included in Contract Sum as required, and prior to the execution of Work described in Allowances.

1.04 ALLOWANCE DISBURSEMENT

A. Contractor shall submit a request for allowance disbursement to the District Representative. Include all substantiating and/or required data along with the request.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.01 SCHEDULE OF ALLOWANCES

A. Include in the base bid the following allowances ~~noted in the Contract Documents~~ in the following amounts: ***ADD-3***

Title	Description	Amount
1) F&E REVISIONS	Furniture and/or equipment revisions such as, but not limited to: additional provisions for backing, power, and data. ***ADD-3***	$30,000
2) UNFORESEEN CONDITIONS	Unforeseen underground conditions such as, but not limited to: existing soils, utilities and the related verification, relocation and/or abatement. ***ADD-3***	$40,000
3) REVISION TO THE AIR HANDLING UNIT COOLING COIL CAPACITY	To provide cooling coil discharge air temperature at 51 degrees at each of the three air handling units. ***ADD-3***	$25,000

END OF SECTION 01 21 00

SECTION 012300

ALTERNATES

Revised, Addendum #3, 09/22/2017

Revised, Addendum #2, 09/01/2017

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. This Section specifies administrative and procedural requirements governing alternate bid items.

1.02 RELATED SECTIONS:

A. Instructions to Bidders.

B. Bid Form and Designation of Subcontractors.

C. Section 011100: Summary of Work.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.01 SPECIFIC

A. Bid alternate item is an amount proposed by bidder and stated on the Bid and Acceptance Form for certain Work defined in the Bidding Documents that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change in either the amount of Work to be completed, the Contract Documents, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The amount added or deducted from the base bid is the net addition to or deducted from the base bid to incorporate bid item Work into the Work. Unless noted otherwise, no other adjustments are made to the Contract Amount, Milestones, or the Contract Time.

3.02 PROCEDURES

A. Contractor shall modify or adjust affected adjacent Work as necessary to completely and fully integrate Owner accepted bid alternate Work.

1. Include as part of each bid alternate item, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the bid alternate item.

B. Accepted bid alternate items are subject to the same terms and conditions as other Work of the Contract Documents.

3.03 SCHEDULE OF BID ALTERNATE ITEMS: (See the Contract Documents for Additional Information)

~~A. Alternate 1 (ADD): Provide a 3-year extended warranty for the following work categories: Site Utilities, Landscape, Elevator, Plumbing, HVAC, Electrical, Communications, Laboratory Equipment, Laboratory Fume Hoods, and General Contractor.~~ ***ADD-2***

B. Alternate 1 (ADD): Provide <MP-1> cladding at horizontal portion of the north canopy in lieu of using <TPO-1> thermoplastic single ply roofing. Drain locations shall remain unchanged. See sheet A445 for additional info. ***ADD-2***

~~*C.* Alternate 2 (ADD): Provide a 3-year extended warranty for Work of the following the following work categories: Site Utilities, Landscape, Elevator, Plumbing, HVAC, Electrical, Communications, Laboratory Equipment, Laboratory Fume Hoods, and General Contractor. ***ADD-2*** ***ADD-3***~~

C. Alternate 2 (ADD): Provide a 3-year extended warranty for Work of the following specification sections: 115315 Fume Hoods and Other Air Containment Units; 115343 Laboratory Service Fittings and Fixtures; 115350 Laboratory Equipment; 142423 Hydraulic Elevators; 211313 Automatic Sprinkler System; Division 22 Plumbing (all sections); Division 23 Heating, Ventilating, and Air-Conditioning (HVAC) (all sections); Division 26 Electrical (all sections); Division 33 Utilities (all sections). ***ADD-3***

D. Alternate 3 (ADD): Use Quarter Sawn Hickory, NHLA Grade FAS at exposed and semi-exposed conditions in lieu of using Plain sawn Maple, NHLA Grade FAS and Quarter Cut Hickory with Transparent finish for veneer in lieu of Plain-sliced White Maple and Stain color for all lab casework. See Spec Section 115310 for additional info. ***ADD-2***

E. Alternate ~~3~~ 4 (DEDUCT): Use high performance paint <HPC-1> on steel handrails for all stairs instead of stainless steel handrails. ***ADD-2***

F. Alternate 5 (DEDUCT): Provide Custom Aluminum Perforated Panels in lieu of Extruded Aluminum Fins (FIN-1) at Mural supporting structure per Construction Documents. See Drawing Sheet A474 for additional information and specification Section 055000, ***ADD-3***

END OF SECTION 012300

SECTION 017836

WARRANTY PROCEDURES

Revised, Addendum #3, 09/22/2017

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section includes procedural requirements for warranties, including manufacturers and installer's standard warranties on products and special product warranties.

1.02 RELATED SECTIONS

A. Facilities Lease Agreement.

B. Section 013229: Project Forms

C. Section 017329: Cutting and Patching.

D. Division 2 through Division 33.

1.03 SUBMITTALS

A. Form of Submittal: In accordance with the Facilities Lease Agreement, compile two (2) copies of each required final warranty properly executed by Contractor, or by Contractor and Subcontractor, installer, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Specifications and provide a table of contents.

B. Bind warranties and bonds in heavy-duty, commercial-quality, durable three ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ by 11 paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the item or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.

2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title and/or name, and name of Contractor.

3. When warranted Work requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

C. Provide one (1) electronic version of all documents listed above on one (1) flash drive to the District Representative.

D. Provide a Warranty Guarantee Form on the District's form provided in Section 01 32 29 as part of the Closeout documentation.

E. Time of Warranty Submittal: ***ADD-3***

1. Commencement of Warranty Period: All warranties covering the Work of this Contract shall be written to commence on the date of Final Completion. Any indication within these Project Manuals for commencement of warranties on the date of Substantial Completion shall hereafter be changed to reflect a warranty commencement date coinciding with Final Completion.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION (Not applicable)

END OF SECTION 017836

SECTION 018113
SUSTAINABLE DESIGN REQUIREMENTS - LEED FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED~~[**Certified**] [**Silver**] [**Gold**] [**Platinum**] certification~~ Silver Equivalence based on USGBC's "LEED 2009 for New Construction & Major Renovations." (See attached certification planning spreadsheet).). Achievement of any particular pre-requisite, credit, group of credits or achievement of any certification level is not guaranteed because there are many factors, actions and decisions outside the control of design and construction team that can affect achievement of the certification. ***ADD-2, ADD-3***

1. Contractor and subcontractors must prepare written plans for fulfillment of LEED credits. See attached LEED Certification Planning Spreadsheet.
2. Other LEED prerequisites and credits needed to obtain LEED certification depend on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits should be considered when evaluating substitution requests and comparable product requests.
3. Some LEED requirements depend on actions that are not Work of this Contract.
4. A copy of the “LEED NC 2009 Certification Planning Matrix” is attached at the end of this Section for information only.

B. Assist Owner and Owner’s Agent for LEED with providing documentation, completing LEED templates so project can be submitted for LEED 2009 for New Construction & Major Renovations certification.

C. Prepare required documentation and submittals described in this Section, throughout the Contract Documents and as documented in the LEED 2009 for New Construction & Major Renovations reference guide and online submittal portal.

D. This Section governs entirety of Construction Documents and Work of this Contract must conform to requirements of this Section whether or not this Section is referenced by other Sections in Construction Documents.

E. Conform to the requirements of the Living Build Challenge 2.1 for avoiding materials listed on the Red List, except as included in Construction Documents.

1.2 LEED PREREQUISITES

A. Prerequisite SS 1, Construction Activity Pollution Prevention: Requires an erosion and sedimentation control plan complying with certain EPA recommendations or local requirements if more stringent.

B. Prerequisite SS 2, Environmental Site Assessment: Requires that a Phase I Environmental Site Assessment to determine if there is site contamination, and if suspected, conduct a Phase II Environmental Site Assessment.

C. Prerequisite WE 1, Water Use Reduction: Requires increased water efficiencies within buildings employing strategies to reduce water usage by 20 percent from baseline buildings.

D. Prerequisite WE 2, Minimize Potable Water Use for Medical Equipment Cooling: Requires all medical equipment will not be using potable water for cooling, except for emergency backup systems.

E. Prerequisite EA 1, Fundamental Commissioning of the Building Energy Systems: Requires that commissioning be performed to verify that the building's energy related systems are installed, calibrated and perform according to the owner's project requirements (OPR), basis of design , and construction documents.

F. Prerequisite EA 2, Minimum Energy Performance: Requires compliance with the mandatory provisions and the prescriptive requirements or performance requirements of ASHRAE/IESNA Standard 90.1-2007 (with errata but without amendments). It affects the selection of materials that make up the building envelope, mechanical and electrical systems.

G. Prerequisite EA 3, Fundamental Refrigerant Management: Requires Zero use of CFC-based refrigerants in new base building HVAC&R systems. Complete a comprehensive CFC phase-out conversion prior to project completion if existing base building HVAC equipment, containing CFCs, is reused.

H. Prerequisite MR 1, Storage & Collection of Recyclables: Requires the provision of a dedicated area for the collection and storage of non-hazardous materials for recycling.

I. Prerequisite MR2, PBT Source Reduction – Mercury: Requires to reduce mercury-containing products and devices and mercury discharge through product substitution, capture and recycling.

J. Prerequisite EQ 1, Minimum IAQ Performance: Requires compliance with Sections 4 through 7 in ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality. Naturally ventilated buildings shall comply with ASHRAE 62.1-2004, paragraph 5.1.

K. Prerequisite EQ 2, Environmental Tobacco Smoke (ETS) Control: Requires that smoking be prohibited within the building and that designated outside smoking areas be located at least 50 feet away from entries, outdoor-air intakes, bus stops, qualifying places of respite, operate windows and other locations where occupants could inadvertently come in contact with ETS when occupying, entering or leaving the building .

1.3 DEFINITIONS

A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

1.5 ACTION SUBMITTALS

A. This Contract includes administrative submittal requirements under each Section for LEED information required to demonstrate compliance with LEED pre-requisites and credits. This Contract includes providing completed USGBC LEED letter template online and hardcopy documentation for credits assigned to Contractor for the construction phase. Cooperate with others assigned to submit letter templates and provide information or documents needed to complete those templates.

B. General: Provide LEED submittals required by Specification Sections. This contract includes providing LEED submittals required by LEED online and LEED 2009 for New Construction & Major Renovations Reference Guide whether or not specified in individual Specification Sections.

C. Provide documentation required for LEED certification in addition to submittals required for normal construction approvals.

D. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project, excluding mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment. Include statement indicating total cost for wood-based materials used for Project.

E. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

F. LEED Documentation Submittals:

1. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over ~~[time] [~~a period of time of not less than one year of postconstruction occupancy~~]~~. ***ADD-2***
2. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
3. ~~Credit MR 3: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.~~ ***ADD-3***
4. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material cost for each product having recycled content.
5. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
6. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
7. Credit IEQ 3.1:
   a. Construction indoor-air-quality management plan.
   b. Product data for temporary filtration media.
   c. Product data for filtration media used during occupancy.
   d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
8. Credit IEQ 3.2:
   a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
   b. Product data for filtration media used during flush-out and during occupancy.
   c. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
9. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
10. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.

11. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
   1. Furniture.
   2. Plumbing.
   3. Mechanical.
   4. Electrical.
   5. Specialty items such as elevators and equipment.
   6. Wood-based construction materials.

C. LEED Action Plan and Progress Reports: Provide action plan and status reports of LEED credit compliance for each pre-requisite and credit as agreed at commencement of Work and at least monthly thereafter. Prior to sub-contracting, provide a report showing compliance with each LEED credit targeted. In addition, submit regular reports comparing actual construction and purchasing activities with pre-requisites and credits shown on spreadsheet for provided by Architect:
   1. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
   2. ~~Credit MR 3: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.~~ ***ADD-3***
   3. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
   4. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
   5. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
   6. Credit IEQ 3.1: Construction indoor-air-quality management plan.

D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
   1. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
   2. ~~Credit MR 3: Salvaged, refurbished, and reused materials.~~ ***ADD-3***
   3. Credit MR 4: Recycled content.
   4. Credit MR 5: Regional materials.
   5. Credit MR 7: Certified wood products.

1.7 QUALITY ASSURANCE

A. Construction Team LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator. Construction team LEED coordinator for the site will coordinate with and cooperate with Project LEED Administrator.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 MATERIALS COST INFORMATION

A. Construction Materials Cost Data
   1. Provide a Construction Materials Cost Data Report summarizing total cost of all construction materials used.
   2. Breakdown the materials cost by Specification Division.
   3. Provide cost for individual materials with detail needed to show compliance with applicable MR credits.
   4. Provide Construction Materials Cost Data Report at end of construction.

~~2.3 SALVAGED, REFURBISHED, OR REUSED MATERIALS~~ *ADD-3*

~~A. Credit MR 3: Not less than **5** [**10**] percent of building materials (by cost) shall be salvaged, refurbished, or reused materials. The following materials may be salvaged, refurbished, or reused materials: *ADD-2*~~

~~1. <Insert list of materials>.~~

2.4 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of **10** ~~[**20**]~~ percent of cost of materials used for Project. ***ADD-2***
   1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
   2. Do not include ~~[**furniture,**]~~ plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation. ***ADD-2***

2.5 REGIONAL MATERIALS

A. Credit MR 5: Not less than **10** ~~[**20**]~~ percent of building materials (by cost) shall be regional materials. ***ADD-2***

2.6 CERTIFIED WOOD

A. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
   1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
      a. Rough carpentry.
      b. Miscellaneous carpentry.
      c. Heavy timber construction.
      d. Wood decking.
      e. Metal-plate-connected wood trusses.
      f. Structural glued-laminated timber.
      g. Finish carpentry.
      h. Architectural woodwork.
      i. Wood paneling.
      j. Wood veneer wall covering.
      k. Wood flooring.
      l. Wood lockers.
      m. Wood cabinets.
      n. Furniture.

2.7 LOW-EMITTING MATERIALS

A. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Metal-to-Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesive: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesive: 100 g/L.
18. Structural Wood Member Adhesive: 140 g/L.
19. Single-Ply Roof Membrane Adhesive: 250 g/L.
20. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
21. Top and Trim Adhesive: 250 g/L.
22. Plastic Cement Welding Compounds: 250 g/L.
23. ABS Welding Compounds: 325 g/L.
24. CPVC Welding Compounds: 490 g/L.
25. PVC Welding Compounds: 510 g/L.
26. Adhesive Primer for Plastic: 550 g/L.
27. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
30. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
31. Other Adhesives: 250 g/L.
32. Architectural Sealants: 250 g/L.
33. Nonmembrane Roof Sealants: 300 g/L.
34. Single-Ply Roof Membrane Sealants: 450 g/L.
35. Other Sealants: 420 g/L.
36. Sealant Primers for Nonporous Substrates: 250 g/L.
37. Sealant Primers for Porous Substrates: 775 g/L.
38. Modified Bituminous Sealant Primers: 500 g/L.
39. Other Sealant Primers: 750 g/L.

B. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: VOC not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC not more than 150 g/L.
3. Dry-Fog Coatings: VOC not more than 400 g/L.
4. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
7. Pretreatment Wash Primers: VOC not more than 420 g/L.
8. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
9. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
10. Floor Coatings: VOC not more than 100 g/L.
11. Shellacs, Clear: VOC not more than 730 g/L.
12. Shellacs, Pigmented: VOC not more than 550 g/L.
13. Stains: VOC not more than 250 g/L.

C. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

PART 3 EXECUTION

3.1 [REFRIGERANT] [AND] [CLEAN-AGENT FIRE-EXTINGUISHING-AGENT] REMOVAL

A. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections.

B. Credit EA 4: Remove clean-agent fire-extinguishing agents that contain HCFCs or halons and replace with agent that does not contain HCFCs or halons. See Section 212200 "Clean-Agent Fire-Extinguishing Systems" for additional requirements.

3.2 MEASUREMENT AND VERIFICATION

A. Credit EA 5: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation ~~[Option D: Calibrated Simulation, Savings Estimation Method 2]~~ in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction," and as further defined by the following: ***ADD-2***

1. ~~<Insert measurement and verification plan design team submitted for credit>~~ Verify implementation plan with Owner for ongoing monitoring and potential correction of building energy consumption while in operation. ***ADD-2***

B. If not already in place, install metering equipment to measure energy usage. Monitor, record, and trend log measurements.

C. Evaluate energy performance and efficiency by comparing actual to predicted performance.

D. Measurement and verification period shall cover at least one year of postconstruction occupancy.

3.3 CONSTRUCTION WASTE MANAGEMENT

A. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."

3.4 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
2. Replace all air filters immediately prior to occupancy.

B. Credit IEQ 3.2:[Comply with one of the following requirements:]

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. (4 300 000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.
   a. ~~<Insert operating requirements>~~ Will require +/- 2 weeks of 100% outdoor air flush. ***ADD-2***
2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. (1 070 000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air or the design minimum outside air rate determined in Prerequisite IEQ 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. (4 300 000 L/sq. m) of outside air has been delivered to the space.
   ~~a. <Insert operating requirements>.~~ ***ADD-2***

3. Air-Quality Testing:
   a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide."
   b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
      1) Formaldehyde: 27 ppb.
      2) Particulates (PM10): 50 micrograms/cu. m.
      3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
      4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
      5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
   c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
   d. Air-sample testing shall be conducted as follows:
      1) All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
      2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
      3) Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. (2300 sq. m) or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
      4) Air samples shall be collected between 3 and 6 feet (0.9 and 1.8 m) from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

Revised, Addendum #3, 09/22/2017

Revised, Addendum #2, 09/01/2017

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. Normal Weight Concrete: Concrete having a density of approximately 150 pcf made with gravel or crushed stone aggregates.

C. Shore: A temporary support designed to support formwork, fresh concrete, and construction loads from above for recently built structures that have not developed full design strength.

D. Strength Test: The average of the compressive strengths of two or more cylinders made from the same sample of concrete and tested at 28 days or at the specified test age.

E. Structural Lightweight Concrete: Structural concrete made with lightweight aggregate; the equilibrium density, as calculated by ASTM C 567, usually is in the range of 90 to 115 pcf with a minimum compressive strength of 2500 psi.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture stamped and signed by a Civil or Structural licensed in the State of California. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.
2. Include historical strength test records if design mixture is based on field experience.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installers.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.

4. Steel reinforcement and accessories.
5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

D. Material Test Reports: For the following, from a qualified Testing Agency, indicating compliance with requirements:
   1. Aggregates.

E. ICC ES Evaluation Reports: For evidence of Building Code compliance:
   1. Mechanical splices and connectors for reinforcing steel.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5. Sections 1 through 5 and Section 7, "Lightweight Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent Testing Agency to perform material evaluation tests and to design concrete mixtures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Dowel Bar Sleeves: Circular PVC sleeve, sealed one end, dowel bar embedment plus 1 inch in length, and 1/16 inch annular space inside diameter.

C. Deformed Bar Anchors: ASTM A 496, deformed steel wire; AWS D1.1/D1.1M, Type C.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

E. Mechanical Splices and Connectors: Comply with ACI 318 and ACI 439.3, Type I and Type II.

1. Furnish splicing and connector system with current ICC ES Evaluation Report.

2.4 CONCRETE MATERIALS

A. Regional Materials: Provide concrete that has been manufactured within 500 miles of Project site from aggregates and/or cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I or Type II. Supplement with the following:
   a. Fly Ash: ASTM C 618, Class F or C.

C. Normal-Weight Aggregates: ASTM C 33, Class 1N coarse aggregate, well-graded. Provide aggregates from a single source.

1. Maximum Coarse Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C 330, expanded shale, presize before firing, 3/4-inch nominal maximum aggregate size.

E. Water: ASTM C 94/C 94M.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, ~~15~~10 mil. Include manufacturer's recommended adhesive or pressure-sensitive tape. ***ADD-2***

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand, at least ~~3~~2 inches thick; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates. ***ADD-3***

2.7 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

2.8 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Reglets: Fabricate reglets in concrete to receive flashing from other trades of not less than 0.022-inch thick galvanized-steel sheet. See Division 07 Section “Sheet Metal Flashing and Trim”. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent Testing Agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent maximum. If Fly ash is greater than 15% by weight, the mix design shall be proportioned per ACI 318 Section 5.3.

C. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise indicated on Drawings.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint or use PVC dowel bar sleeve.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, or built-up or membrane roofing.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values (SOV) of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values (MLV) of flatness, F(F) 17; and of levelness, F(L) 15.
    b. Specified overall values (SOV) of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values (MLV) of flatness, F(F) 24; and of levelness, F(L) 17; for surfaces to receive thin-set flooring.
3. For floor installations 10,000 sq. ft. or less in total project area, finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (90 percent compliance) in accordance to ACI 117 Section 4.8.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Slip-Resistive Finish: Before final floating, apply slip-resistive aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aluminum granules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aluminum granules.

G. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.

2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three

hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply liquid to concrete sooner than that recommended by manufacturer.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
4. Repair technique shall be tested on a mockup or surface to be concealed later, before repairing surfaces exposed to view, for approval by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to

reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified Testing Agency to perform field tests and inspections and prepare test reports.

B. Inspections: Verify and inspect concrete Work as shown on Drawings.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. of concrete, or for each 2000 sq. ft of surface area of slabs or walls thereof of each concrete mixture placed each day. Additional samples for 7-day tests shall be taken for each type of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder plus one spare standard cylinder specimens for each composite sample.

b. To verify concrete strength for removal of shoring and reshoring in multistory construction, cast and field cure sets of two standard cylinder specimens for each composite sample. Number of field cured sets to be determined by Contractor.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
   a. If 28-day compressive-strength test falls below satisfactory levels, strength test the spare cylinder at age determined by the Contractor and average with the strength of the 28-day specimens. The average strength of the three cylinders shall be considered one compressive-strength test.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete Testing Agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing Agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing Agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to within 24 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 040516
MASONRY MORTARING AND GROUTING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mortar and masonry grout for unit masonry.
   2. Testing of mortar and masonry grout.
   3. Admixtures for mortar and masonry grout.

B. Related Sections:
   1. Section 040520 - Masonry Accessories.
   2. Section 042000 - Unit Masonry.

1.2 REFERENCES

A. IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

B. IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

1.3 SUBMITTALS

A. Submit manufacturer's recommendations and product data in accordance with Section 013300.

B. Submittals shall be in accordance with Section 013300 and be prepared by an approved testing laboratory.

C. Mortar Submittals:
   1. Submit mix designs for each type of mortar to be used and state building components in which each will be used. Indicate whether proportion or property specification of ASTM C270 is used on each mix design.
   2. Submit Reference Test data as specified by ASTM C270.
   3. Submit Reference Test data indicating minimum bond strength of 20 psi when tested in accordance with ASTM E518 or 100 psi when tested in accordance with ASTM C1072.

D. Submit mix designs for each type of masonry grout to be used and state building components in which each will be used. Use proportion specification of ASTM C476 as minimum criterion and design for minimum compressive strength of 3000 psi when tested in accordance with ASTM C1019. Submit Reference Test data.

E. Prior to installing unit masonry using colored mortar, construct sample wall panels to verify selections made under sample submittals and to demonstrate aesthetic effects of materials and execution.

1.4 QUALITY ASSURANCE

A. Testing of Mortar and Masonry Grout shall be by approved testing laboratory as specified in Section 014500.

B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate. Choose mortar ingredients that will not produce effloresence.

1.5 TESTING

A. Use representative samples of mortar and masonry grout materials and proportions to be utilized in construction.

B. Mortar Tests:
   1. Perform tests of mortar and mortar materials to ensure conformance with requirements stated herein.
   2. Flexural Bond Strength Test: ASTM E518 or ASTM C1072.
   3. Mortar Composition and Properties: Test and evaluate per ASTM C780. For compressive strength tests, provide 3 inch by 6 inch mortar cylinders.
   4. Water Retention Tests: ASTM C91, Article 20.

C. Masonry Grout Tests:
   1. Sampling and testing of masonry grout shall be in accordance with ASTM C1019.
   2. Masonry units used to create molds for samples shall be same type of units used in construction. Wood blocks shall be at base of sample and permeable liner shall be used at sides of sample to prevent bond with masonry units. Molds and sample shall remain undisturbed for 48 hours prior to transporting samples to laboratory. Sample size shall be 3 1/2 inches square by 7 inches high.

D. If mortar tests do not indicate conformance with requirements stated herein, re-establish and resubmit for further testing. Pay costs for required retesting.

E. Payment of Reference Tests (tests performed prior to construction): By Contractor.

F. Payment of Construction Progress Tests (tests performed during construction): By Owner.

1.6 PRODUCT HANDLING

A. Storage: Store mortar materials off ground, under cover, and in dry location.

PART 2 PRODUCTS

2.1 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type I, non-staining without air-entrainment and of natural color.

B. Masonry Cement: Masonry cement not allowed.

C. Aggregates for Mortar: ASTM C144.

D. Aggregates for Masonry Grout: ASTM C404.

E. Hydrated Lime: ASTM C207 Type S, without air-entrainment.

F. Premix Mortar: Commercially prepared premix of low alkali Portland cement, hydrated lime, and aggregates; ASTM C387; mortar Type M, S, N.
   1. Optional Mortar Cement (in lieu of Portland Cement and Lime); Lafarge Mortar Cement Complying with Uniform Building Code for Mortar Cement. Use at Contractor's option.

G. Water: Potable.

2.2 ADMIXTURES

A. Mortar Color: Premeasured, non-fading, concentrated mineral oxide pigment, appropriate for addition to Portland cement/lime mortar mix.
   1. Provide in color as selected from manufacturer’s standard range.
   2. Manufacturers:
      a. Tamms Industries,
      b. Solomon Grind-Chem Service,
      c. Euclid’s Super Concentrated Mortar Color,
      d. DCS Color and Supply,
      e. Prism Pigments.

B. Chemical Resisting Mortar:
   1. Manufacturers:
      a. Atlas Minerals and Chemicals,
      b. Ceilcote Company,
      c. Ameron Corrosion Control Division.

C. Water-Repellent Admixture: Dry-Block integral water-repellent admixture intended for use with CMUs containing integral water repellent from same manufacturer. ***ADD-3***
   1. Manufacturers:
      a. Grace Masonry Products.

D. Latex Additive: Brock-White latex liquid or Duraweld.
   1. (Use for mortar at stone sills, and wall caps.)

2.3 MORTAR MIXES

A. Mortar for Non-Load Bearing Interior Walls and Partitions: ASTM C270, type as scheduled using Proportion specification.

B. Mortar for Structural Unit Masonry (indicated on structural drawings): ASTM C270, type as scheduled using Property specification.

C. Pointing Mortar: ASTM C270. Type as scheduled using proportion specification.

D. Stain Resistant Pointing Mortar: ASTM C270. Type as scheduled using proportion specification.

2.4 MASONRY GROUT MIXES

A. For use in filling bond beams, concrete unit masonry cells with reinforcing bars, and other cells or cavities as indicated. Comply with ASTM C476.

B. Use coarse grout in grout spaces 2 inches or more in least horizontal dimension, unless otherwise indicated.

C. Use fine grout in grout spaces less than 2 inches in least horizontal dimension, unless otherwise indicated.

D. Add sufficient water to produce mix of suitable consistency for placing without segregation. Slump range: 8 inches to 11 inches.

E. Use fine aggregate size No. 2 for fine grout and coarse aggregate size No. 8 for coarse grout in accordance with ASTM C404.

PART 3 EXECUTION

3.1 MIXING MORTAR

A. Mortar Ingredients: Thoroughly mix in accordance with ASTM C270 in quantities needed for immediate use.

B. Mortar Admixtures: Add in accordance with manufacturer's recommendations. Ensure uniformity of mix and colorations.
   1. Consult with and follow manufacturer's directions on: Use, quantity and mixing of admixtures; various conditions affecting mixing and pouring; mix designs and procedures. Show proposed admixtures on mix designs and do not use unless shown.

C. Ensure that sand is uniformly damp immediately before mixing.

D. Do not use anti-freeze compounds to lower freezing point of the mortar. Do not use calcium chloride in the mortar.

E. Use mortar within 2 hours of mixing at temperatures over 80 degrees F and 2-1/2 hours at temperatures under 50 degrees F.

F. If water is lost by evaporation, retemper mortar only within 2 hours of mixing. Do not retemper mortar after 2 hours of mixing.

3.2 MORTAR TYPE SCHEDULES

A. Exterior Cavity Wall: Type S mortar in masonry back-up wall with Type N mortar in face brick veneer.

B. Interior Bearing Walls: Type S mortar.

C. Masonry Below Grade: Type S mortar.

D. Interior Non-Load Bearing Walls: Type N mortar.

E. Glass Unit Masonry: Type N mortar with Type O pointing mortar.

3.3 MORTAR COLOR SCHEDULES

A. Mortar Color: Color as selected.

3.4 MIXING MASONRY GROUT

A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for Fine or Coarse grout.

B. Add admixtures in accordance with manufactures instructions. Mix thoroughly.

C. Do not use anti-freeze compounds to lower the freezing point of the grout. Do not use calcium chloride in the grout.

3.5 CONSTRUCTION PROGRESS TESTING

A. Mortar Testing. Provide two 3 inch by 6 inch mortar cylinders as described in Article 1.5 on first 10,000 masonry units laid or first 2 weeks work whichever occurs first. Thereafter if tests are acceptable, provide 2 test cylinders for each 50,000 masonry units or every 4 weeks, whichever occurs first.

B. Masonry Grout Testing. For every 15 cubic yards of masonry grout placed, or for each days work when less than 15 cubic yards is placed, provide 3 samples. Test 1 sample at 7 days of age for projecting probable 28 day strength and 2 samples at 28 days for acceptance of average as required for evaluation and acceptance per ACI 318.

END OF SECTION

SECTION 042000
UNIT MASONRY

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Burnished concrete masonry units
   3. Installation of reinforcing bars and deformed bar anchors in unit masonry.
   4. Installation of anchor bolts and other embedments in unit masonry
   5. Installation of masonry anchorage, reinforcing and accessories specified in Section 040520.
   6. Graffiti coating. ***ADD-2***

B. Related Sections:
   1. Section 033000 - Cast-In-Place Concrete.
   2. Section 040516 - Masonry Mortaring and Grouting.
   3. Section 040520 - Masonry Anchorage, Reinforcing and Accessories.
   4. Section 051200 - Structural Steel: Items to be built in masonry work.
   5. Section 055000 - Metal Fabrications: Items to be built in masonry work.
   6. Section 072100 - Thermal Insulation: For cavity spaces.
   7. Section 076210 – Sheet Metal Flashing and Trim: Reglets to be built in masonry work.
   8. Section 079000 - Joint Protection: Sealants for expansion and contraction joints.

1.2 REFERENCES

A. ANSI A41.1 - Building Code Requirements for Masonry.

B. ACI 530.1/ASCE 6 - Specifications for Masonry Structures.

1.3 SUBMITTALS

A. Product Data and Test Reports: Submit manufacturer's recommendations, product data and test reports in accordance with this section and Section 013300.

B. Shop Drawings: Submit in accordance with Section 013300 for stone trim in form of cutting and setting drawings showing sizes, profiles, and location of each stone trim unit required.

C. Samples: Submit samples of each type of unit masonry for color selection and appearance acceptance.
   1. Burnished concrete unit masonry.

1.4 QUALITY ASSURANCE

A. Reference Standards: Comply with requirements of listed standards unless indicated otherwise herein.

B. Fire-Rated Masonry: Wherever fire-resistance classification is shown or scheduled for unit masonry construction, comply with requirements for materials and installation established by governing authorities for construction shown.

C. Test Data: Provide evidence and test data confirming that concrete block conform to standards stated herein.

D. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or uniform blend within ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

E. Job Mock-Up: Prior to installation of masonry work, erect sample wall panel mock-up using materials, bond and joint tooling required for final work.
   1. Build mock-up at site, where directed, of full thickness and approximately 4 feet by 4 feet, indicating proposed range of color, texture and workmanship to be expected in completed work.
   2. Architect's acceptance of visual qualities of mock-up before start of masonry work. Provide separate mock-up panel for each type of exposed unit masonry work.
   3. Where masonry is to match existing, erect panels parallel to existing surface.
   4. Mock-up to show following assemblies as part of masonry construction.
      a. Back-up wall, ties, insulation, vapor retarder
      b. Building corner
      c. Sealant joints
      d. Window opening with vapor retarder terminations shown.

1.5 TESTING

A. Testing of Concrete Masonry Units:
   1. Tentative Acceptance: For tentative acceptance of blocks provide tests and reports on minimum of 5 units, from current stock, to provide proof of ability to conform to ASTM Standards. Texture, dimension, tolerance, appearance and test reports will be basis for tentative acceptance of supplier of blocks.

B. Prism Testing:
   1. F'm-1500 psi unless noted otherwise on drawings.
   2. Compressive strength of masonry assembly (f'm) may be determined by one of the following methods:
      a. Provide compressive strength of masonry units to achieve required F'm per CBC Table 2105.2.2.1.2 for Type 'M' or 'S' mortars.
      b. Prism testing per CBC 2105.2.2.2 and ASTM C1314.
         1) Prior to construction, notify Architect in writing of method to be used.
         2) When prism testing is used to determine F'm, construct and test not less than 3 prisms prior to construction for each strength specified.

C. Mortar strength test in accordance with ASTM C780.

D. Graffiti Coating Testing: ***ADD-2***
   1. Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use the manufacturer's application instructions. Let test area protective treatment cure before inspection. Keep test panels available for comparison throughout the protective treatment project.

1.6 MASONRY TO STEEL STUD TIE TESTING

A. Owner will retain and pay for ITL (Independent Testing Laboratory) to perform pull out testing on masonry anchors attached to steel studs.

B. Type of testing equipment shall be hydraulic or other testing apparatus as determined by ITL.

C. Provide ITL with description of materials and installation procedures and methods.

D. Perform field testing (use approximately 150 lbs per tie) on selected area of 20 square feet of installed masonry anchors at start of anchor installation. Test area shall represent same materials and methods utilized for remainder of project.

E. If required by testing results, adjust materials or methods to obtain secure masonry anchor attachment.

F. After adjustment, if necessary, masonry anchor testing on remainder of project shall be accomplished on indiscriminate basis as determined by ITL, testing one anchor out of approximately 150 installed anchors.

G. Exact testing program, pattern and procedure to be used will be established by ITL with change of test procedure and additional testing as determined by ITL.

1.7 APPEARANCE OF CONCRETE MASONRY UNITS

A. Appearance Requirements: Concrete masonry units shall be light in color, with uniform fine texture, free of face smears.
   1. Do not use broken units. Chipped or other defective units will not be acceptable for use where exposed. Not over 5 percent of units will be permitted to have chips and chips shall not exceed 3/8 inch.
   2. Exposed concrete masonry unit walls shall have units uniform in size, texture and color.
   3. Architect reserves the right to reject unit masonry manufacturer if, in Architect's opinion, unit quality, color or texture is unacceptable with design intent.
   4. Appearance requirements may be waived by Architect for concealed units.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units off ground, under cover, and in dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in air-dried condition.

C. Store cementitious materials off ground, under cover, and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, 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 48 inches down both sides and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 48 inches down face next to unconstructed wythe and hold cover in place.
   3. Maintain protective boards at exposed external corners which may be damaged by construction activities. Provide such protection without damaging completed work.
   4. Protect sills, ledges and projections from droppings of mortar.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread 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.

D. 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 ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

1.10 PROTECTION

A. Provide temporary bracing during erection of concrete block work. Maintain in place until building structure provides permanent bracing.

B. Heat materials and provide temporary protection of completed portions of masonry work. Comply with governing codes and with "Construction and Protection Recommendations for Cold Weather Masonry Construction" of Technical Notes on Brick and Tile Construction by Brick Institute of America (BIA). Extend covering at least 2 feet down both sides of walls and hold securely in place.

C. Prevent mortar or soil from staining face of masonry to be left exposed or painted. Remove immediately mortar in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

D. Protect sills, ledges and projections from droppings of mortar.

PART 2 PRODUCTS

2.1 CONCRETE UNIT MASONRY

~~A. Concrete Blocks: Modular size, load bearing, ASTM C90.~~

~~1. (CMU-1) Normal weight Class 1: C33 Aggregate. Unless concrete block is indicated as "light weight block", provide normal weight concrete block.~~

~~a. Size:~~

~~1) Nominal, as indicated.~~ ***ADD 3***

B. Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless indicated as bullnose.

C. Curing: Kiln and air cured under cover until age of blocks is at least 45 days. Autoclave cured type block may be used.

2.2 DECORATIVE CONCRETE MASONRY UNITS

A. (CMU-11) and (CMU-12) Ground Faced (Burnished) Concrete Masonry Units: ASTM C90, normal weight units (minimum 125 pcf), moisture controlled curing, with manufacturer's standard dissipating block protection.

1. Load Bearing Unit Shapes: All units (excluding lintel, cap and sill block units) to be Plain Double Corner; Single Open End, ("A" shaped); or Double Open End, ("H" shaped) units.
2. Type: Provide special shapes where indicated on the Drawings
3. Sizes:
   a. (CMU-11): Nominal 4" x 8" x 16" at all Site walls and Generator Enclosure wall.
      1) Wall Cap: 4" x 8" x 16" Solid CMU cap, finish to match wall block. ***ADD-3***
   b. (CMU-12): Nominal 4" x 12" x 16" at Greenhouse foundation wall.
      1) Wall Cap: 4" x 12" x 16" Solid CMU cap, finish to match wall block ***ADD-3***
4. Colors: Refer to Material Identification Codes.
5. Acceptable manufacturer:
   a. ORCO Block Co.
   b. Or District approved equal.

B. Integral Water Repellent: Provide (CMU-12) units made with integral water repellent

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen. ***ADD-3***

2.3 GRAFFITI COATING *ADD-2*

A. Product and Manufacturer: Sure Klean® Weather Seal Blok-Guard® & Graffiti Control Ultra 15 manufactured by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797. E-mail: CustomerCare@prosoco.com

1. Product Description: A high performance, clear, solvent-based silicone elastomer formulated to weatherproof concrete block and other porous masonry materials and protect treated surfaces from repeated graffiti attacks with little to no change to the natural appearance.
2. Graffiti removal is fast and easy using Defacer Eraser® Graffiti Wipe.
3. Typical Technical Data
   - Form: Clear liquid, petroleum odor
   - Specific Gravity: 1.28
   - pH: not applicable
   - Weight/gallon: 10.62 pounds
   - Active content: 15 percent
   - Total solids: 15 percent ASTM D2369
   - VOC content: less than 100 grams per Liter
   - Flash point: 100 degrees F (38 degrees C) ASTM D3278
   - Freeze point: less than -22 degrees F (less than -30 degrees C)
   - Shelf life: 1 year in tightly sealed, unopened container

PART 3 EXECUTION

3.1 PREPARATION

A. Ensure items built-in by other trades for this work are properly located and sized. Fill in solidly with masonry around built-in items. Fill space between hollow metal frames and masonry solidly with mortar.

B. Establish lines, levels and coursing. Protect from disturbances.

C. Rake out mortar in preparation for application of sealants, where required.

3.2 CONCRETE BLOCK WORKMANSHIP AND INSTALLATION

A. Place masonry in accordance with lines and levels indicated on Drawings. Lay from exposed side, plumb, level and true to modular dimensions.

B. Fully bond external and internal corners.

C. Install joint reinforcing, anchors and ties in full mortar surround and where necessary fill voids in blocks to provide full bed to completely imbed items.

D. Keep concrete block dry, under cover and lay only clean, dry undamaged units. Do not lay units with moisture content over 40 percent.

E. Lay hollow concrete masonry units with full mortar coverage on vertical face shells. Bed webs in mortar in starting course.

F. Lay solid masonry units with completely filled bed and head joint, except at expansion and control joints. Butter ends with sufficient mortar to fill head joints and shove into place.

1. Do not slush head joints.
2. Bevel rear of bed joint at cavity to exclude mortar from protruding into cavity.

G. Isolate masonry partitions from vertical structural framing members with control joint, with mortar raked back 3/4 inch install backer rod and sealany.

H. Do not shift or tap masonry after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.

I. Ensure masonry courses are of uniform height. Make vertical and horizontal joints equal and of uniform thickness. in full bed of mortar, properly jointed with other work.

J. Remove excess mortar and projections. Take care to prevent breaking masonry corners. Do not let mortar fall into cavity air space, clean out promptly.

K. Perform job site cutting of masonry with proper power tools to provide straight and true, unchipped edges.

L. Lay exposed concrete block in running bond with vertical joint in each course centered on units in course above and below.

M. Where piping and conduit run in masonry, work with other trades to coordinate work. Cut out center bridges in block to create voids for pipes or conduit. Where pipes or conduit exit from wall, drill neat holes to provide neat unpatched walls.

N. Build inner wythe ahead of outer wythe to receive insulation or vapor retarder adhesive.

O. Strike flush and then tool to dense sealed surface mortar joints that will be covered by earth.

P. Tool exposed joints slightly concave to dense smooth surface without overlaps from horizontal to vertical joints. Tool exposed mortar when thumbprint hard. Joints behind ceramic tile shall be flush. Rake out mortar in preparation for application of sealants, where required.

3.3 TOLERANCES

A. Maximum variation from masonry unit to adjacent masonry unit: 1/16 inch.

B. Maximum variation from vertical and horizontal building lines: 1/4 inch in 10 feet.

C. Maximum variation from cross sectional thickness of cavity and composite walls: Plus or minus 1/4 inch.

D. Maintain flush face on exposed masonry surfaces.

E. Lay concrete block to receive thinset ceramic tile plumb, with flush mortar joints and with maximum surface variation of 1/8 inch in 10 feet.

3.4 REINFORCEMENT AND ANCHORAGES

A. Place masonry reinforcing as shown on Drawings and in accordance with Section 040523 - Masonry Accessories.

B. Reinforce walls, except masonry veneer, with continuous horizontal joint reinforcing and masonry ties. Fully embed longitudinal side rods in mortar for entire length with minimum cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations.

C. Anchor single wythe masonry veneer to concrete back-up with dovetail anchors. Provide additional anchors within 1 foot of openings.

D. Fully reinforce corners and intersections.

E. Lap masonry reinforcing splices minimum 6 inches.

3.5 COREFILL AND GROUT

A. Place corefill concrete at intervals not to exceed 5 feet of wall height during construction of walls, unless cleanouts are provided in which case 8 foot lifts may be used.

B. Rod or vibrate corefill to insure complete filling of cells.

C. Allow at least 15 minutes between successive pour lifts to permit settlement.

D. Stop intermediate pours at least 1-1/2 inch below mortar joint.

E. Exercise care during filling of cells to insure reinforcement is properly positioned. Tie vertical bars to joint reinforcing at 32 inch centers to maintain their proper location.

F. Use care to prevent mortar droppings from accumulating at base of cells. Provide temporary clean out openings, if necessary, at base of cells in order to remove droppings prior to placement of corefill concrete.

3.6 BOND BEAMS AND LINTELS

A. Provide reinforced concrete block lintels over openings where indicated on drawings.

B. Construct lintels and bond beams using concrete and reinforcing steel specified to PCA recommendations. Maintain minimum 6 inch bearing on each side of openings. Erect on full even beds of mortar with minimum one course filled-core hollow units under lintels and beams.

C. For lintels, use reinforcing bars of full lengths only.

D. Place and consolidate concrete without disturbing reinforcing. Construct lintels on plank, adequately supported, joints equally spaced. Do not support lintels with hollow metal door frames. Fill spaces around built-in items solid with masonry and mortar unless otherwise indicated. Clean out spaces prior to pouring concrete fill.

E. Allow lintels to reach 90 percent design strength or 28 days before removing temporary supports. Remove units that show evidence of cracking.

3.7 JOINT FILLERS AND DEFLECTION MATERIAL

A. Install fillers in accordance with manufacturer's printed instructions. Compressible fillers shall be of joint size.

B. Set units at proper depth or position in joint to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units. Recess exposed edges or faces or compressible fillers slightly behind adjoining surfaces so that compressed units will not protrude from joint.

3.8 THROUGH-WALL FLASHING AND WEEP SYSTEMS

A. Place through wall flashings in accordance with manufacturer's recommendations.

B. Install flashing as block is laid and protect from damage. Lap ends and seal, with laps in direction of moisture flow.

1. Adhesive apply and anchor flashing in place to prevent moisture from penetrating behind or under flashing.
2. At flashing horizontal terminations, construct end dams 1 block course in height with joints lapped and sealed.

C. Install rope wicks over flashing, cut flush with mortar face and leave end of wicks visible to insure drainage. Install at head joint location, at bottom of cavity walls, and at lintels and relieving angles. Secure at 45 degree angle to back-up.

D. Install cavity drainage mat at locations where flashing and weeps are required.

E. Install block vents in accordance with manufacturer's written instructions. Install at head joint locations, at bottom of cavity walls, and at lintels and relieving angles.

3.9 CONTROL JOINTS AND CONSTRUCTION JOINTS

A. Provide control joints in block work as indicated and where shown on Drawings, or if not shown, locate at 40 feet maximum for horizontal run of wall.

B. Do not continue horizontal masonry reinforcing across joints. End reinforcing approximately one inch either side of joints.

C. Form joints in block work, straight and true.

D. Keyed Control Joint in Bond Beams: At continuous bond beams, provide keyed control joint at construction joints.

1. Extend rebar beyond joint minimum of 18 inches.
2. Use 2X wood block drilled to allow rebar to pass through wood block.

3. Set block inside of bond beam and coat with form release agent.
4. Secure block in place before pouring bond beam.

3.10 BUILT-IN WORK

A. As work progresses, build-in items as indicated and required, including, hollow metal frames, window frames, steel angle lintels, nailing strips, anchor bolts, plates, sleeves, hangers, supports, and other items supplied by other trades. Wherever bolts, brackets and similar anchor items are cast-in masonry, fill voids in masonry with mortar to adequately anchor and transmit loads.

B. Build-in items plumb and true to lines and levels.

C. Bed anchors of hollow metal frames in mortar joints. Fill masonry cores at jambs with grout for full projection of frame anchors.

D. Do not build-in organic materials which will be subjected to rot or deterioration.

3.11 CUTTING AND FITTING

A. Cut and fit concrete block for chases, pipes, conduit, sleeves, and grounds. Cooperate with other sections of work to ensure correct size, shape and location. Provide not less than 8 inches of masonry between chase or recess and jamb of openings. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges.

B. Obtain Architect's review prior to cutting or fitting any area not indicated on drawings, or which may impair appearance or strength of masonry work.

3.12 PARTITIONS

A. General: Carry masonry partitions up to structure above, unless otherwise noted.

B. Openings Through Walls: Except as otherwise indicated, where piping, conduit or similar features pass through walls, carefully fill spaces to block sound. Fill voids to permit movement and deflection. Fill solid around obstructions and voids to form effective closures.

C. Joint to Structure Above: Provide joint between masonry and over-structure and pack voids solidly with deflection material. Filling of voids shall permit movement and deflection. Fill solid around obstructions and voids to form effective closure.

D. Sand Filled Cores: Where indicated, fill cores in masonry wall solid with sand, full height of wall. Sand as specified in Section 040516 – Masonry Grouting.

3.13 GRAFFITI COATING *ADD-2*

A. Apply graffiti coating in accordance with manufacturer's written instructions.

B. Applied with low-pressure spray, brush or roller, graffiti coating penetrates and fills pores to prevent water penetration through exterior walls exposed to normal weathering and protects treated surfaces from repeated graffiti attacks.

C. Apply enough graffiti coating in a single saturating application to completely wet the surface without creating drips, puddles or rundown. Brush out or back roll all runs and drips for uniform appearance. Do not over apply. One application is normally enough.

D. If a second coat is required or recommended, apply the second coat as soon as the first coat is dry to touch, or within 2 hours of the first coat. Immediately back roll or brush out runs and drips for a uniform appearance and to prevent build up. Allowing more than 2 hours between coats reduces effectiveness of the second coat.

3.14 FIELD QUALITY CONTROL - LEVEL 1 NONESSENTIAL FACILITIES

A. Testing and Inspection: Owner will engage qualified special inspectors in accordance with Section 014533.

1. Qualifications: The minimum category of special inspector required to perform services outlined below are noted by qualifications in parentheses. The definitions of the categories of special inspector are included in Section 014533.

B. Coordinate with independent testing and inspecting agency engaged by the Owner to perform field quality control inspection and testing.
   1. Provide necessary scaffolding or temporary platforms required by testing agency in order to perform their work. Such scaffolding or platforms shall comply with safety regulations and shall be acceptable to testing agency.

C. Inspection of masonry is required during preparation of masonry wall prisms, sampling and placing of masonry units, placement of structural reinforcement, cleanout of grout space immediately prior to closing of elements and during all grouting operations.

D. "Continuous" Inspection of Masonry: Inspections noted below as being continuous shall be performed uninterrupted each day while the specific task is being performed.
   1. Continuous inspection shall be provided for 100% of shear walls, masonry beams and masonry columns.

E. "Periodic" inspection of masonry: Inspection items noted below as being periodic shall be performed at least once per 1,000 square feet of surface but not less than once per week.

F. Samples and Tests for Special Inspections: (Technical II)
   1. Construction Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof, but not less than one set for the project.
      a. One set shall consist of testing three samples.
   2. Masonry Unit Tests – Perform in accordance with CBC Chapter 21.
      a. For each type of unit provided, verify units conform to strength, absorption, and unit weight requirements of ASTM C 55 or ASTM C 90 when tested in accordance with ASTM C 140.
      b. Provide units which match accepted samples as to texture and general character. Appearance will be an element considered for conformance. Contractor must arrange for tests and for delivery to laboratory.
   3. Masonry Prism Tests – Perform in accordance with CBC Chapter 21.
      a. For each type of construction provided, verify compressive strength of masonry equals or exceeds specified f'_m when tested in accordance with ASTM C 1314.
      b. Preparation, storage, handling of prism tests. (Contractor will provide labor and materials to construct all prism tests.)
   4. Mortar Tests for Unit Masonry Complying with ASTM C270 Proportion Specifications:
      a. For each mix provided, test mortar for initial consistency and board life, mortar aggregate ratio, and mortar air content in accordance with ASTM C 780.
   5. Mortar Tests for Unit Masonry Complying with ASTM C270 Property Specifications:
      a. For each mix provided, test mortar for initial consistency and board life, mortar air content and compressive strength in accordance with ASTM C 780.
   6. Flexural Bond Strength Testing:
      a. For each type of construction provided at the following applications, test mortar for flexural bond strength in accordance with ASTM E 518 or ASTM C 1072.
         1) Below grade masonry basement walls or retaining walls in contact with earth.
         2) Exposed exterior, above grade, load-bearing and non-load-bearing walls, and parapet walls.
   7. Grout Testing for each mix provided:
      a. Test grout for temperature in accordance with ASTM C 1064.
      b. Test grout for slump in accordance with ASTM C 143.
      c. Test grout for strength in accordance with ASTM C 1019. For each 50 cu yds placed or each day's work, whichever is less, make 3 grout samples and test one sample at 7 days and remaining 2 at 28 days.

G. Masonry Preparation and Placement (Technical II)
   1. Base Conditions: On a periodic basis, verify that masonry bearing surfaces are clean.
   2. Condition of Units: On a periodic basis, verify that masonry units are clean, sound and dry.
   3. Proportions of site prepared mortar: On a periodic basis, verify proportions of prepared mortar are consistent with previously submitted materials.
   4. Placement: On a periodic basis, inspect laying of masonry units for the following: nominal unit widths, stack or running bond, proper thickness and tooling of mortar joints, acceptable depth of furrowing of bed joints. Note temperature at time of inspection.

5. Joints: On a periodic basis, inspect construction, expansion and contraction joints for location and continuity of steel.
6. On a periodic basis, verify hot and cold weather procedures are followed.
7. On a periodic basis, verify wall cavities are protected against entry of precipitation.

H. Masonry Reinforcement (Structural I)
1. Vertical Reinforcement: On a periodic basis, inspect placement and alignment of vertical bars and dowels for size, grade and spacing. Inspect length of lap splices, clearances between bars, clearances to masonry units and outside face of walls and positioning of steel.
2. Horizontal Reinforcement: On a periodic basis, inspect horizontal joint reinforcement (HJR) steel and masonry reinforcement bars for size, length of lap splices, dowels, clearances between bars, clearance to masonry units and outside face of walls and alignment.
3. Ties: On a periodic basis, inspect ties in masonry for type, straightness, embedment, spacing and size.
4. Dowels and Anchors: On a periodic basis, inspect the installation of masonry anchor bolts, joist anchors, inserts, straps and dowels.

I. Prior to Masonry Grouting and Capping (Technical II)
1. Grout Spaces: On a periodic basis, verify that grout spaces are correctly sized and clean, cleanouts are closed after inspection and grout barriers are in place before grouting.
2. Reinforcement: On a periodic basis, verify placement of reinforcement and connectors remains consistent with Contract Documents.
3. Site Prepared Grout: On a periodic basis, verify proportions of site prepared grout are consistent with previously submitted materials.

J. During Grout Placement (Technical II)
1. Grouting:
   a. Continuously observe proper grouting technique including consolidation to approved height of grout space, cleanouts, rebar positioning, reconsolidation and vibration.
   b. Grout Specimens: Observe 100% of preparation of all required grout specimens, mortar specimens, and/or prisms to be tested.
2. Dry Packing: On a periodic basis, verify proper application of dry packing.

3.15 FIELD QUALITY CONTROL - LEVEL 2 ESSENTIAL FACILITIES

A. Testing and Inspection: Owner will engage qualified special inspectors in accordance with Section 014533.
1. Qualifications: The minimum category of special inspector required to perform services outlined below are noted by qualifications in parentheses. The definitions of the categories of special inspector are included in Section 014533.

B. Coordinate with independent testing and inspecting agency engaged by the Owner to perform field quality control inspection and testing.
1. Provide necessary scaffolding or temporary platforms required by testing agency in order to perform their work. Such scaffolding or platforms shall comply with safety regulations and shall be acceptable to testing agency.

C. Inspection of masonry is required during preparation of masonry wall prisms, sampling and placing of masonry units, placement of structural reinforcement, cleanout of grout space immediately prior to closing of elements and during all grouting operations.

D. "Continuous" Inspection of Masonry: Inspections noted below as being continuous shall be performed uninterrupted each day while the specific task is being performed.
1. Continuous inspection shall be provided for 100% of shear walls, masonry beams and masonry columns.

E. "Periodic" inspection of masonry: Inspection items noted below as being periodic shall be performed at least once per 1,000 square feet of surface but not less than once per week.

F. Samples and Tests for Special Inspections: (Technical II)
1. Construction Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof, but not less than one set for the project.

a. One set shall consist of testing three samples.
2. Masonry Unit Tests – Perform in accordance with CBC Chapter 21.
   a. For each type of unit provided, verify units conform to strength, absorption, and unit weight requirements of ASTM C 55 or ASTM C 90 when tested in accordance with ASTM C 140.
   b. Provide units which match accepted samples as to texture and general character. Appearance will be an element considered for conformance. Contractor must arrange for tests and for delivery to laboratory.
3. Masonry Prism Tests – Perform in accordance with CBC Chapter 21.
   a. For each type of construction provided, verify compressive strength of masonry equals or exceeds specified f'_m when tested in accordance with ASTM C 1314.
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4. Mortar Tests for Unit Masonry Complying with ASTM C270 Proportion Specifications:
   a. For each mix provided, test mortar for initial consistency and board life, mortar aggregate ratio, and mortar air content in accordance with ASTM C 780.
5. Mortar Tests for Unit Masonry Complying with ASTM C270 Property Specifications:
   a. For each mix provided, test mortar for initial consistency and board life, mortar air content and compressive strength in accordance with ASTM C 780.
6. Flexural Bond Strength Testing:
   a. For each type of construction provided at the following applications, test mortar for flexural bond strength in accordance with ASTM E 518 or ASTM C 1072.
      1) Below grade masonry basement walls or retaining walls in contact with earth.
      2) Exposed exterior, above grade, load-bearing and non-load-bearing walls, and parapet walls.
7. Grout Testing for each mix provided:
   a. Test grout for temperature in accordance with ASTM C 1064.
   b. Test grout for slump in accordance with ASTM C 143.
   c. Test grout for strength in accordance with ASTM C 1019. For each 50 cu yds placed or each day's work, whichever is less, make 3 grout samples and test one sample at 7 days and remaining 2 at 28 days.

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2. Condition of Units: On a periodic basis, verify that masonry units are clean, sound and dry.
3. Proportions of site prepared mortar: On a periodic basis, verify proportions of prepared mortar are consistent with previously submitted materials.
4. Placement: On a periodic basis, inspect laying of masonry units for the following: nominal unit widths, stack or running bond, proper thickness and tooling of mortar joints, acceptable depth of furrowing of bed joints. Note temperature at time of inspection.
5. Joints: On a periodic basis, inspect construction, expansion and contraction joints for location and continuity of steel.
6. On a continuous basis, verify hot and cold weather procedures are followed.
7. On a continuous basis, verify wall cavities are protected against entry of precipitation.

H. Masonry Reinforcement (Structural I)
1. Vertical Reinforcement: On a continuous basis inspect placement and alignment of all vertical bars and dowels for size, grade and spacing. Inspect length of lap splices, clearances between bars, clearances to masonry units and outside face of walls and positioning of steel.
2. Horizontal Reinforcement: On a periodic basis, inspect horizontal joint reinforcement (HJR) steel and masonry reinforcement bars for size, length of lap splices, dowels, clearances between bars, clearance to masonry units and outside face of walls and alignment.
3. Ties: On a periodic basis, inspect ties in masonry for type, straightness, embedment, spacing and size.
4. Dowels and Anchors: On a continuous basis inspect the installation of masonry anchor bolts, joist anchors, inserts, straps and dowels.

I. Prior to Masonry Grouting and Capping (Technical II)
1. Grout Spaces: On a continuous basis, verify that grout spaces are correctly sized and clean, cleanouts are closed after inspection and grout barriers are in place before grouting

2. Reinforcement: On a periodic basis, verify placement of reinforcement and connectors remains consistent with Contract Documents.
3. Site Prepared Grout: On a periodic basis, verify proportions of site prepared grout are consistent with previously submitted materials.

J. During Grout Placement (Technical II)
1. Grouting:
   a. Continuously observe proper grouting technique including consolidation to approved height of grout space, cleanouts, rebar positioning, reconsolidation and vibration.
   b. Grout Specimens: Observe 100% of preparation of all required grout specimens, mortar specimens, and/or prisms to be tested.
2. Dry Packing: On a periodic basis, verify proper application of dry packing.

3.16 CLEANING

A. Wipe off excess mortar as work progress. Dry brush at end of each days work. Remove excess mortar and smears upon completion of masonry work.

B. Point or replace defective mortar. Match adjacent work.

C. After mortar is thoroughly set and cured, clean exposed surfaces with masonry cleaner in accordance with cleaner manufacturer's printed instructions. Use non-metallic tools in cleaning operations.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous and ornamental metal, except structural steel framing as specified in Section 051200 and defined as structural steel in AISC "Code of Standard Practice".
   2. Supports, anchorage and accessories for miscellaneous metal and ornamental metal work.
   3. Shop prime paint on ferrous metal.
   4. Shop prime for (Section 099600) high performance coating, where indicated.
   5. Pre-engineered metal stair system as follows:
      a. Engineering of metal stair system including handrails and connections to building structure.
      b. Steel pan type stairs and landings, with integral handrails and balusters, plates, angles, hangers, struts and welds for securing to building structure.
   6. Steel handrails and guardrails.
   7. Galvanized metal gratings and supports.
   8. Steel framing, supports and mounting plates at overhead doors.
   9. Ladders.
   10. Bollards.
   11. Sliding metal gate.
   12. Metal fin.
   13. Perforated Metal
      a. (MET FAB-10)
      b. Bid Alternate for (FIN-1) ***ADD-3***

B. Related Sections:
   1. Section 017325 - Seismic Restraint Requirements for Nonstructural Components
   2. Section 033000 – Cast-In-Place Concrete.
   3. Section 042000 - Unit Masonry.
   4. Section 051200 - Structural Steel Framing.
   5. Section 089100 - Louvers.
   6. Section 099000 – Painting: Finish painting.
   7. Section 099600 - High Performance Coatings: Coating of Architecturally Exposed metal fabrication steel (AES).

1.2 REFERENCES

A. AWS D1.1 - Structural Welding Code.

B. SSPC PS7.01 - Steel Structures Painting Council.

C. Specification for Design of Cold-Formed Steel Structural Members by American Iron and Steel Institute.

D. ANSI A14.3 Safety Code for Fixed Ladders.

1.3 STAIR SYSTEM DESCRIPTION

A. General: Provide complete stair and landing systems including stringers, landing framing, treads, landings, connections and other components necessary for the support and installation of stairs and landings, comply with NAAMM requirements for Service Class Stairs.

B. Structural Performance of Stairs: Provide metal stairs capable of withstanding following structural loads without exceeding allowable design working stress of materials involved, including anchors and connections. Apply each load to produce maximum stress in each component of metal stairs.

1. Treads and Platforms of Metal Stairs: Capable of withstanding uniform live load of 100 lb/sq ft or concentrated load of 300 lb/sq ft on area of 4 sq. in., whichever produces greater stress.
2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.
3. Design and construct stair components and connections capable of withstanding seismic forces in any direction and capable of accommodating seismic relative displacements. Refer to Section 017325 for seismic design, loading and deflection criteria.
4. Egress stair components and connections as defined in the life safety plan or as indicated in the Section 017325 Responsibility Matrix shall be designed as a “Designated Seismic Systems”
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied at any point and in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Intermediate Rails, Balusters and Panel Fillers Not Serving as Top Rails:
      a. Concentrated load of 50 lbf (0.22 kN) applied normal to the plane of the rail or panel on an area not to exceed 1 sq. ft. (0.093 sq. m).
      b. Infill load and other loads need not be assumed to act concurrently.

1.4 SUBMITTALS

A. Comply with Section 013300.

B. Shop Drawings: Indicate dimensions, description of materials and finishes; include plans, elevations, sections, and details of railings and their connections and reactions to building structure. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections, and installation procedures, including specific requirements indicated.
   1. Indicate design criteria and reactions to structure.
   2. Construction details, sizes of metal sections, thickness of metals, profiles, attachments, dimensions and field joints, method of support from structure, and finishes.
   3. Work to be built-in or provided by other Sections.
   4. Welding: Indicate welded connections, both shop and field, using standard AWS welding symbols. Indicate net weld lengths.
   5. Provide shop drawings signed and sealed by qualified professional engineer responsible for their preparation licensed in State where project is located.

C. Calculations: Structural design shall be performed by a Professional Engineer, licensed in the state where Project is located, indicating structural integrity of members, anchors, fasteners and connections to building structure, in accordance with specified criteria. Submit signed engineering calculations concurrently with the shop drawings to Architect/Engineer upon request.
   1. Engineering Responsibility: Calculations shall be reviewed for stated design assumptions, general compliance to specified requirements, and forces imposed on structure. The accuracy of the design calculations shall be the sole responsibility of the Contractor’s Professional Engineer.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.5 QUALITY ASSURANCE

A. Applicable Standards: AISC "Specifications for Design of Cold-Formed Steel Structural Members" and AWS "Structural Welding Code".

B. Qualification for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

C. Field Measurements: Take field measurements prior to fabrication to insure proper fitting of work.

D. Shop Assembly: Preassemble metal items in shop to greatest extent possible, so as to minimize field splicing and assembly. Disassemble units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

E. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.

F. Professional Engineer Qualifications: Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of handrails and railing systems that are similar to those indicated for this Project in material, design, and extent of work.

1.6 HANDLING AND STORAGE

A. Load, unload, handle and store work in manner that will not bend, deform or otherwise damage metal. Store so metal and shop coats will not be subject to weather or moisture, store off ground and provide covering for metal in storage.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces: For fabrication of miscellaneous metal work items which will be exposed to view, use only materials which are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names and roughness. Select steel for exposed work to provide best possible appearance.

B. Steel Plates, Shapes and Bars: ASTM A36.

C. Steel Tubing: ASTM A501 or ASTM A500.

D. Steel Pipe: ASTM A53, Type S, Grade A, standard weight and extra-strong as required, galvanized and plain.

E. Galvanized Sheet Metal: ASTM A526 or A527, G-90 coating designation with both sides of metal prime painted.

F. Galvanizing: ASTM A123, hot dip galvanizing, thickness Grade 55 unless otherwise indicated.

1. Galvanize exterior steel fabrications, steel at exterior wall locations, and where steel is exposed to weather.

G. Fasteners: As indicated and recommended by manufacturer. Provide zinc- coated fasteners for exterior use or where built into exterior walls.

1. Provide stainless steel fasteners where indicated and where dissimilar metals are connected. Where dissimilar metals are connected, provide neoprene spacer or washer for isolation.

H. Stainless Steel: ASTM A167, Type 304 with #4 finish. Passivate exterior stainless steel.

I. Metal Primer Paint: Provide comparable primer recommended by finish coat manufacturer which is lead and chromate free, Low VOC complying with VOC guidelines.

1. Primer for Metal to Receive High Performance Coatings (HPC): See Section 099600 for products to be applied by this Section.
2. Primer to Receive Fire Protection Treatment: See applicable Division 7 Section for primer to be applied by this Section.
3. Primers for Painting: See Section 099000 for primers to be applied by this Section.

2.2 FABRICATION

A. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to radius of 1/32 inch, unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

B. Weld corners and seams continuously and in accordance with AWS. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

C. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible.

D. Fabricate and space anchoring devices to provide adequate support. Cut, reinforce, drill and tap metal work to receive finish hardware and similar items.

E. Shop Painting: Remove scale, rust and other deleterious materials before shop coat of paint is applied. Apply shop coat of metal primer to fabricated metal items in accordance with manufacturer's printed instructions, with full coverage of joints, corners and edges.

F. Primer: High Performance Coating: At high performance painting use SSPC-6, complying with Section 099600.

1. Apply shop primer after surface preparation in compliance with primer manufacturer's instructions at a rate to provide uniform dry film thickness of 1.5 mils, maintain minimum coverage at joints, corners, edges and exposed surfaces.

2.3 HANDRAILS AND RAILINGS

A. (RAIL-3), (RAIL-4), (RAIL-5), (RAIL-6) ~~and (MET RAIL-1), (MET RAIL-2), (MET RAIL-4) and (MET RAIL-5)~~ Types and Handrail Sizes: Refer to Material Identification Codes. ***ADD-3***

B. Cope intersections of rails and posts, weld joints and grind smooth. Butt weld end-to-end joints of railing or use welding connectors.

1. Galvanize exterior handrails and railings.

C. Weld corners and seams continuously and in accordance with recommendations of AWS. Grind exposed welds smooth and flush, to match and blend with adjoining surface. Discoloration of finished surfaces is not acceptable.

D. Form exposed connections with flush, smooth, hairline joints, using concealed fasteners. Provide for anchorage to supporting structure. Fabricate and space anchoring devices as indicated and required for adequate support.

E. Provide brackets, flanges, and anchors for railing posts and for handrail supports. Provide inserts and sleeves for anchorage to concrete or masonry work.

F. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.

G. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.

H. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings.

2.4 STAIR FABRICATION

A. (MET FAB-1): Shop fabricated steel stair, steel pan concrete filled.

B. General:

1. Verify dimensions on site prior to shop fabrication.
2. Fit and shop assemble sections in largest practical sizes, easily handled through building openings.
3. Accurately form and fit components and connections. Grind exposed edges and welds smooth and flush.
4. Accurately form components required for proper anchorage of stairs and landings, and integral railings to each other and to building structure.

5. Thoroughly clean surfaces of rust, scale, grease, and foreign matter prior to galvanizing or prime painting. Allow to dry thoroughly before applying priming material.

C. Fabrication of Stairs and Landings:
   1. Fabricate stairs with closed risers and treads of pan construction.
   2. Form treads and risers from sheet stock.
   3. Properly secure tread pans to stringers with clip angles welded in place.
   4. Form stringers of rolled steel channels or steel plate sections, as required to meet performance requirements. Weld fascia plates of minimum 14 gage thick sheet stock across channel toes, where applicable.
   5. Form landings of sheet stock. Reinforce underside of landings with angles, tees as required.
      a. Fabricate stairs, landings and component connections to support live loads of minimum 100 lb./sq.ft. with deflection of stairs and landings not exceeding 1/360 of span when underside is to be finished with gypsum board and 1/240 of span when underside is not being finished.

D. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

E. Fabrication of Handrails and Guardrails:
   1. Handrails: Handrails shall have an outside diameter of 1-1/2".
   2. Inside handrails shall be continuous and shall sweep around smoothly at landings.
   3. Outside handrails shall be mounted on wall brackets as required to meet performance requirements and shall have extensions at top and bottom of stair runs as indicated on the Drawings and required by accessibility standards.
   4. Intermediate Guard Configuration: Intermediate guard shall be configured as indicated on drawings.
      a. Provide railing system consisting of 1-1/2 inch round sloping strands following each stair run and 1-1/2 inch round top rails that continuously sweep around at each corner.
   5. At top floor of stair system and at each floor landing (except lower level) provide 3'-6" high guard rails.
   6. Continue handrail and intermediate guard system down to the lower level where concrete stairs are indicated.

2.5 METAL SUPPORT ASSEMBLY

A. (MSA) Metal Support Assembly Manufacturer and Type:
   1. Unistrut Corporation:
      a. Unistrut Metal Framing.
      b. UMS Boom Supports
   2. Cooper B-Line Strut Systems,
   3. Hilti USA:
      a. Hilti Strut Framing.
      b. Hilti Medical Equipment Supports.
   4. Or District approved equal.
   5. Propriety equipment supports systems to be approved by the Architect.

B. (MSA-1) Individual Metal Support Assembly: Metal support assembly designed to provide support for individual piece of equipment,
   1. Provide support assembly for individual pieces of equipment as shown on the architectural reflected ceiling plan.
   2. Verify loading, deflection criteria and tolerance requirements with equipment supplier. See structural drawings for special loading requirements.
   3. Design and construct assembly, including anchorage, to withstand seismic forces in any direction. Refer to Section 017325 for seismic loading criteria and restraint requirements.
   4. Provide lateral diagonal bracing, orthogonal in two directions to prevent assembly from racking due to seismic forces.
   5. Verify bolting plate assembly requirements with equipment supplier.
   6. located and spaced as indicated on Drawings or as required by the equipment supplier.

2.6 METAL GRATINGS

A. (GRT-1) Galvanized Metal Gratings: Borden Metal Products Type B size 5 pressure locked steel gratings with 1-1/4 inch by 1/8 inch bearing bars at 1-3/16 inch centers and 3/4 inch by 1/8 inch cross bars at 4 inch centers, galvanized finish in accordance with ASTM A123.

2.7 METAL GRILLES

A. (GRL-1) Aluminum ceiling grille.

B. (GRL-2) Aluminum wall grille.

2.8 METAL LADDERS

A. (MET FAB-2) Interior Steel Ladder:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. Height as indicated on Drawings.
3. Siderails: Continuous, 3/8 by 2-1/2 inch steel flat bars, with eased edges. Space siderails 16 inches apart, unless otherwise indicated.
4. Rungs: 3/4 inch diameter steel bars at 12 inches on center.
5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
7. Support each ladder at top and bottom, and not more than 60 inches o.c. with welded or bolted steel brackets.
8. Prime with zinc-rich primer.

2.9 BOLLARDS

A. (MET FAB-8) Removable Bollards: Trafficguard Model TL 1004 R, or District approved equal, as indicated on Drawings and consisting of the following components:

1. 5 inch dia. pipe.
2. Exposed pipe above footing: 36” high.
3. Concrete footing per manufacturer’s written instructions with sleeve for pipe in concrete footing.
4. Tamper proof lock provided for securing cover when bollard removed.

B. (MET FAB-9) Bollards Imbedded in Concrete: Trafficguard Model RFP 4560 R, or District approved equal. Hot-dipped galvanized steel pipe, 5 inch dia., concrete filled, crowned cap, prime paint finish only the exposed top 3'-6".

1. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
2. Fill bollards solidly with concrete, mounding top surface to shed water.

2.10 SLIDING METAL GATE

A. (GATE-1) Sliding Metal Gate: Ameristar PassPort II ~~Classic~~ Majestic Industrial Roll Gate System as manufactured by Ameristar Fence Products, Inc., Tulsa, OK, (888) 333-3422, www.ameristarfence.com ***ADD-3***

1. Steel material for roll gate components (i.e. pickets, rails, diagonals and uprights), shall be commercial steel with a minimum yield strength of 45,000 psi.
2. Ornamental picket material shall be 1” square x 14 Ga. Tubing. Picket spacing shall be 4-3/4”. Material for toprails, uprights and diagonals rails shall be 2” square x 12 Ga. Material for the bottom rail shall be 2” x 4” x 11 Ga. Posts shall be a minimum of 4” square x 11 Ga.
3. Pickets/pales, rails, uprights and posts shall be precut to specified lengths. Diagonals shall be precut to specified lengths and angles. Frame materials shall be joined by welding. Pickets/pales shall be face welded to roll gate frame.

4. The manufactured roll gates and bolt-on panels (if applicable) shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pre-treatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils. The color shall be selected by the Architect from manufacturer's standard colors.

2.11 METAL FIN

A. (FIN-1) Metal Fin: Extruded aluminum fin, 12' x 3" x 3/8", finish: Light Gray (powder coat).
   1. Profile, Attachment Method, and Fasteners: As indicated on Drawings.
   2. Color and Finish: Match to (MP-3B) ***ADD 3***

2.12 PERFORATED METAL *ADD-3*

A. (MET FAB-10) Perforated Flat Metal:
   1. General: Perforated panels shall be fabricated with a ¾ inch wide non-perforated border wrapping all installed applications.
   2. Material: 12 guage aluminum
   3. Perforations: 3/16-inch diameter round perforations 5/16-inch staggered row centers. 33 percent openness.
   4. Finish: Mill Finish
      a. Basis of Design Manufacturers: McNichols, or Equal
   5. Attachment/Fasteners:
      a. Stainless Steel fasteners at 6 inch o.c., through border into steel bar backup with stainless steel washers

B. BID ALTERNATE for (FIN-1):
   1. Bid Alternate 5: In lieu of (FIN-1), provide custom aluminum perforated panel as follows:
      a. Basis of Design: "Image Wall" as manufactured by Zahner; www.imagewall.com/resources
      b. Material: 0.125-inch perforated aluminum
      c. Finish: Match to (MP-3B)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which miscellaneous metal items are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

C. Perform cutting, drilling and fitting required for installation of miscellaneous metal items. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

D. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch up shop paint coat. Do not weld, cut or abrade surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

F. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 2 mils.

G. Install metal gratings and supports according to reviewed shop drawings and manufacturer instructions.

3.3 METAL SUPPORT ASSEMBLY

A. Examination
   1. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
      a. Do not proceed until unsatisfactory conditions have been corrected.
   2. Take field measurements; report interferences with structural framing, mechanical systems, or other obstructions to Architect.

B. Installation
   1. Install equipment support systems and accessories in accordance with reviewed shop drawings and manufacturer's printed instructions.
      a. Install before extensive electrical, mechanical, ceiling framing or room finish work.
   2. Provide anchorage devices and fasteners for securing equipment support systems to in-place construction.
   3. Attach to structure by means of imbedded concrete inserts, through bolts or by direct attachment to structural framing. If expansion anchors are used to anchor metal framing to support structure locate in such manner that anchor bolt is loaded in shear.
   4. Set system accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

3.4 METAL STAIR ERECTION

A. Erect stairs square, level, plumb and free from distortion or defects detrimental to appearance and performance.

B. Provide necessary anchors, plates, angles, hangers and struts as required for connecting stairs to the structure.

C. Ensure alignment with adjacent construction. Coordinate with related work to ensure no interruption in installation.

D. Perform necessary cutting and altering for installation of work of other sections. Do not perform any other additional cutting without review of Architect.

E. Field bolt and weld to match standard of shop bolting and welding. Hide bolts and screws whenever possible. Where not hidden, use flush countersunk fastenings, unless indicated otherwise. Make mechanically fastened joints flush hairline butted. Grind welds smooth and flush.

F. Touch up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide minimum 2-mil dry film thickness.

3.5 HANDRAILS AND RAILINGS

A. Provide anchorage devices and fasteners for securing handrails and railings to in-place construction.

B. Adjust railing prior to securing in-place to ensure proper matching at butting joints and correct alignment. Secure posts and rail ends to building construction.

C. Anchor steel pipe rails in concrete by means of galvanized pipe sleeves set and anchored into concrete. Provide steel plate closure secured to bottom of sleeve and of width and length not less than one inch greater than sleeve. After post is inserted into sleeve, fill sleeve solid with quick-setting hydraulic cement.

D. Anchor rail ends to supporting structure with flanges welded to rail ends and bolted to supporting members in accordance with reviewed shop drawings. Secure handrails to walls with wall brackets and end fittings.

3.6 SLIDING METAL GATE INSTALLATION

A. Gateposts shall be set in accordance with the spacing's shown in the construction plans. The "Earthwork" and "Concrete" sections of this specification shall govern post base material requirements. 6" wheels shall be bolted to the gate (between the wheel plates welded near the ends of the gate bottom rail). The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening. Roller guides shall be affixed to the gateposts at a height even with the gate toprail to hold the gate in a vertical position. Gate stops shall be welded to the end of the gate or track so gate cannot pass rollers in either direction.

END OF SECTION

SECTION 075420
TPO MEMBRANE ROOFING

Issued, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. (TPOT-1) adhered TPO membrane roofing system with tapered insulation
      a. Roofing manufacturer's requirements for the specified warranty
      b. Preparation of roofing substrates
      c. Vapor Retarder
      d. Roof insulation
      e. Metal roof edging and copings
      f. Flashings
      g. Walkway pads
      h. Roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.
   2. Roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system

B. Related Sections
   1. Section 061000 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
   2. Section 076210 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

1.2 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definition of terms related to roofing work not otherwise defined in the section.

B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC S770.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation 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.
      a. Notify attendees well in advance of Conference date.
   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.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.

B. Samples: Submit samples of each product to be used.

C. Shop Drawings: Provide according to Section 013300.
   1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
   2. For tapered insulation, provide project-specific layout and dimensions for each board.

1.5 INFORMATIONAL SUBMITTALS

A. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.

B. Sample Warranties: For manufacturer’s special warranties

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and that has been producing TPO membrane roofing systems as specified for this project for a period of 20 years.

B. Installer Qualifications: Roofing installer shall have the following:
   1. Manufacturer’s Current Licensed Contractor status
   2. Fully staffed office within 100 miles of the job site
   3. At least five years experience in installing specified system
   4. Capability to provide payment and performance bond to building owner

1.8 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.

1.9 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.

1.10 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

B. Warranty: 20 year Limited Warranty covering membrane, roof insulation, and membrane accessories.
   1. Limit of Liability: No dollar limitation.
   2. Scope of Coverage: Repair leaks in the roofing system caused by:
      a. Ordinary wear and tear of the elements.
      b. Manufacturing defect in Firestone brand materials.
      c. Defective workmanship used to install these materials.
      d. Damage due to winds up to 55 mph.
   3. Not Covered:
      a. Damage due to winds in excess of 55 mph.
      b. Damage due hurricanes or tornadoes.
      c. Hail.
      d. Intentional damage.
      e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Fully-adhered "UltraPly" TPO Membrane Roofing as manufactured by Firestone Building Products, Carmel, IN. www.firestonebpco.com.

B. Acceptable Manufacturers - Roofing System:
   1. Roofing systems manufactured by others are acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
      a. Specializing in manufacturing the roofing system to be provided
   2. Other Acceptable Manufacturers:
      a. GAF Materials Corporation.
      b. Carlisle SynTec, Inc.
      c. Versico, Inc.

C. Source Limitations: Obtain components including roof insulation, coverboards, substrate boards and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing 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. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist uplift pressures established by ASCE/SEI 7 for design loads and roof configurations indicated on Drawings.

D. Exterior Fire-Test Exposure: ASTM E 108 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 ROOFING SYSTEM CONFIGURATION

A. (TPOT-1) Roofing System:
   1. Membrane: Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
      a. Thickness: 60 mils
      b. Membrane Attachment: Adhered.
      c. Comply with applicable local building code requirements.
   2. Roof Insulation:
      a. Total R Value: As indicated
      b. Polyisocyanurate foam board, non-composite.
      c. Tapered Layer: Polyisocyanurate foam board, non-composite.
      d. Attachment: Adhered
   3. Vapor Barrier on Roof Deck

2.4 TPO MEMBRANE MATERIALS

A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:
   1. Thickness: 0.060 inch plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch plus/minus 10 percent.
   2. Puncture Resistance: 265 lbf, minimum, when tested in accordance FTM 101C Method 2031.
   3. Solar Reflectance: 0.81, minimum, when tested in accordance with ASTM C 1549.
   4. Color: White.
   5. Basis of Design Product: Ultraply TPO by Firestone.
      a. Other Accepted Manufacturers:
         1) Johns Mansville
         2) Carlisle
         3) District approved equal.

B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches wide.

D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
   1. Thickness: 0.060 inch plus/minus 10 percent.
   2. Tensile Strength: 1550 psi, minimum, when tested in accordance with ASTM D 638 after heat aging.
   3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D 638 after heat aging.
   4. Tearing Strength: 12 lbf, minimum, when tested in accordance with ASTM D 1004 after heat aging.
   5. Color: White.
   6. Basis of Design Product: Ultraply TPO Flashing by Firestone.

E. Tape Flashing: 5-1/2 inch nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch nominal
   1. Basis of Design: TPO QuickSeam Flashing by Firestone.

F. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing
   1. Basis of Design: Pourable Sealer by Firestone.

G. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

H. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick.

I. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed

1. Basis of Design: UltraPly TPO Cut Edge Sealant by Firestone.

J. General Purpose Sealant: EPDM-based, one part, white general purpose sealant
   1. Basis of Design: UltraPly TPO General Purpose Sealant by Firestone.

K. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.

L. Walkway Pads: As recommended by membrane manufacturer.

2.5 VAPOR RETARDER

A. Fully adhered membrane similar to V-Force Self Adhering Air and Vapor Retarder, or District approve equal: 32 mil thick unreinforced membrane with a permeability rating of 0.05 perms (ASTM E-96), compatible with adhesive. Provide vapor retarder required by membrane manufacturer consistent with system warranty so that all components are from a single manufacturer and each component of roof system is included in warranty.
   1. Primer and Adhesive: Follow manufacturer's written instruction for application of primer and vapor retarder on approved substrates. VOC: less than 100 g/l.
   2. Select Primer capable of withstanding moisture exposure.

2.6 THERMAL BARRIER

A. Type and Manufacturer: 5/8 inch UL rated Dens-Deck gypsum roof board by Georgia-Pacific, or District approve equal.

2.7 ROOF INSULATION

A. Polyisocyanurate Foam Board: Closed cell polyisocyanurate foam core with laminated black glass reinforced mat facer complying with ASTM C 1289.
   1. Density: 2.0 pcf per ASTM D1622
   2. Compressive Strength: 25 psi minimum per ASTM D1621 Procedure A
   3. Meets FM 4450 and UL 1256.
   4. Moisture Vapor Transmission: 1.0 perms maximum.
   5. Thickness: Provide thickness and slope as indicated.
   6. R-Value: 5.6 design stabilized R-value according to RIC/TIMA Bulletin No. 101.

B. Factory taper insulation to provide smooth incline of slopes as shown on drawings. (Factory miter valleys and corners.)

C. Multiple Layers: Furnish in not less than 2 layers.

D. Insulation Fasteners: Refer to Membrane Fasteners specified herein.

2.8 METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.

B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with splice plates; mechanically fastened as indicated.
   1. Material and Finish: 24 gage, 0.024 inch thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching joint splice plates; factory-installed protective plastic film.

2.9 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
   1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.

2. Thickness: Same as thickness of roof insulation.

PART 3 INSTALLATION

3.1 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and approved submittals for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

1. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.

1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.2 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will no strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.3 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.

D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.4 VAPOR RETARDER INSTALLATION

A. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Bond vapor retarder to substrate as follows:

1. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
2. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.5 INSULATION INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.

E. Adhered Attachment: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding adhesive, application rate, and procedures.

3.6 ELASTOMERIC MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Adhered Membrane at Parapet Walls: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding adhesive, application rate, and procedures.

E. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.

1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.7 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.

1. Follow roofing manufacturer's instructions.

2. Remove protective plastic surface film immediately before installation.
3. Install water block sealant under the membrane anchorage leg.
4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.
1. Use the longest practical flashing pieces.
2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
4. Provide termination directly to the vertical substrate as shown on roof drawings.

E. Roof Drains:
1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.
3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.

3.8 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.
1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.9 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes.

B. Perform all corrections necessary for issuance of warranty.

3.10 CLEANING

A. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.

B. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

C. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

D. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 075500

MODIFIED BITUMINOUS MEMBRANE ROOFING

Revised, Addendum #3, 09/22/2017

Re-Issued, Addendum #2, 09/01/2017

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

B. Provide all labor, equipment, and materials to install a complete roofing system over the properly prepared substrate.

C. Contractor must submit certified applicator letter from roofing manufacturer with bid stating that roofing contractor is certified to install specified roofing system.

1.2 SUMMARY

A. Section includes modified bituminous roofing system (MBIT-1) and accessories on all built up roofing sections.

1. Install specified insulation and crickets per plans and details with appropriate coverboard and attach per ASCE 7-05 wind uplift requirements. Coordinate with insulation specification. If no insulation is required on top of deck, mechanically fasten one layer of Type II base sheet – HPR Glasbase.

2. Install two layers of Type IV felts – HPR Glasfelts- in Type III hot asphalt.

3. Install an additional layer of Stressply EUV smooth sheet in hot asphalt in all base flashings, drains, and as a target sheet on all penetrations.

4. Install Stressply Plus FR Mineral capsheet over the entire roof surface in Type III hot asphalt

5. Install Stressply IV UV Plus Mineral Title 24 compliant torch sheet on all vertical walls and base flashings using roofer's torch to adhere. Torch applied sheet must be Title 24 compliant with no factory or field coating applied, Title 24 surface to be bright white minerals.

6. New soft zinc ZinkJak flashings must be used in all drains and pipe penetrations, clamp and caulk per specification.

7. Any mechanical units that sit on solid curbs need to be roofed up and over to make a complete watertight system and then have a new 22ga galvanized metal pan installed before the unit is set in place. All metal seams to be fully soldered.

8. Once roofs are complete and inspected by District and Manufacturer, clean roofs thoroughly with blowers and brooms. Coat all roof sections with 2 gallons per square of White Star polyurea and embed 300 lbs of Title 24 bright white gravel into polyurea while the coating is being applied and still wet.

9. Place all conduits on new redwood blocking and secure with clamps. Blocking should be adhered to a 1/2" thick walkpad from bottom side using mastic. Walkpads under blocking to free float on top of roofing system.

10. Install new 22ga Kynar coated metal for all coping and edge metal. Attach coping cap using continuous clip on outside perimeter and fastening inside edge every 24" O.C. with grommet screws. Metal must be supplied by the membrane manufacturer to qualify for the 30-year edge-to-edge warranty.

1.3 REFERENCES

A. American Society of Civil Engineers (ASCE):

1. ASCE 7-05, Minimum Design Loads for Buildings and Other Structures.

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

1. ASTM D41 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.

2. ASTM D312 Standard Specification for Asphalt Used in Roofing.

3. ASTM D451 Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.

4. ASTM D2822 Standard Specification for Asphalt Roof Cement.

5. ASTM D5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.

6. ASTM D6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

7. ASTM D6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.

8. ASTM E108 Standard Test Methods for Fire Test of Roof Coverings.

C. National Roofing Contractors Association (NRCA):

1. Roofing and Waterproofing Manual.

1.4 SUBMITTALS PRIOR TO AWARD

A. Manufacturer's Installation Instructions: Submit installation instructions and recommendations indicating special precautions required for installing the membrane.

B. Manufacturer's Certificate: Certify that roof system furnished has a class A fire rating.

C. Manufacturer's Certificate: Provide calculations by an engineer that the roof system is adhered/fastened properly to meet or exceed the requirements of ASCE 7-10 wind uplift requirements.

D. Manufacturer's Certificate: Certify that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.

E. Manufacturer's Certificate: Submit a certified copy of the roofing manufacturer's ISO 9001 compliance certificate.

F. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, this testing must show that sheets meet all minimum tensile, tear, and elongation requirements set forth as the standard in this specification.

G. Written certification from the roofing system manufacturer certifying the applicator is currently authorized for the installation of the specified roof system.

H. Written certification from roofing system manufacturer that all materials including miscellaneous items not supplied by said manufacturer will be fully covered under the 30 year NDL Edge to Edge warranty with no exceptions. This includes insulation, fasteners, and asphalt.

I. Certification that polyurea coating and gravel top surface are Title 24 compliant.

J. Qualification data for firms and individuals identified in Quality Assurance Article below.

K. Specimen Warranty: Provide an unexecuted copy of the 30-year NDL Edge to Edge warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner. Warranty must be a no dollar limit warranty, must be non pro-rated, must cover both labor and all materials including insulation and all accessories including all metal flashings (coping, edge metal, counterflashing, etc), and must not have any renewal periods to achieve the full 30-year warranty period.

L. Provide samples of warranties for all built up roofing, metal roofing, and metal wall panels from the same manufacturer. Provide a notarized letter from an officer of the manufacturing company stating that they will warranty all roof systems and cover all transitions between each roofing system.

M. Notarized letter from an officer of the manufacturing company stating that they will provide daily inspections from a full time employee of the company for a

minimum of 1 hour, three days per week with photographic reports daily to the owner.

N. Provide documentation that the manufacture has been in business longer than the specified warranty period (30 years).

1.5 CONTRACT CLOSEOUT SUBMITTALS

A. General: Comply with Requirements of Division 01 Section - Closeout Submittals.

B. Special Project Warranty: Provide 30 year NDL Edge to Edge material and labor warranty as stated in 1.4, K for the Project, executed by the authorized agent of the Manufacturer.

C. Roofing Maintenance Instructions. Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

D. Demonstration and Training Schedule: Provide a schedule of proposed dates and times for instruction of Owner's personnel in the maintenance requirements for completed roofing work. Refer to Part 3 for additional requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with not less than 30 years documented experience and have ISO 9001 certification.

B. Installer Qualifications: Company specializing in modified bituminous roofing installation with not less than 5 years experience and authorized by roofing system manufacturer as qualified to install manufacturer's roofing materials.

C. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress. Maintain proper supervision of workmen.

D. Maintain a copy of the Contract Documents in the possession of the Supervisor/Foreman and on the roof at all times.

E. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001.

F. Manufacturer cannot be in or have been in bankruptcy (Chapter 7 or Chapter 11) in the last ten (10) years.

G. Manufacturer must have been in business for as long as the warranty is to last (30 years).

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Roofing Conference: Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of modified bituminous roofing system installation and associated work.

B. Require attendance of installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, testing agencies and governing authorities. Objectives of conference include:

1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.

2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.

3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.

4. Review roofing system requirements (drawings, specifications and other contract documents).

5. Review required submittals both completed and yet to be completed.

6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

7. Review required inspection, testing, certifying and material usage accounting procedures.

8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).

9. Record discussion of conference including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

10. Review notification procedures for weather or non-working days.

C. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved to the satisfaction of the Owner. This shall not be construed as interference with the progress of Work on the part of the Owner.

1.8 DELIVERY, STORAGE AND HANDLING

A. Contractor responsible to coordinate delivery of products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.

B. Store and handle roofing sheets in a dry, well-ventilated, weather-tight place to prevent moisture exposure. Store rolls of felt and other sheet materials on pallets or

other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (not polyethylene).

C. Do not leave unused materials on the roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.

D. Secure all material and equipment on the job site. If any material or equipment is stored on the roof, assure that the integrity of the deck is not compromised at any time. Damage to the deck caused by the Contractor's actions will be the sole responsibility of the Contractor, and the deck will be repaired or replaced at his expense.

1.9 MANUFACTURER'S DUTIES

A. When the Project is in progress, the roofing system manufacturer will provide the following to all interested parties including Owner, Architect, and Construction Manager:

1. Report progress and quality of the work as observed.

2. Provide job site inspections with photographic reports 5 days per week for a minimum of one hour when contractor is on site.

3. Report to the Owner in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.

4. Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.10 PROJECT CONDITIONS

A. Proceed with roofing work only when existing and forecasted weather conditions will permit a unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.

B. Do not apply roofing insulation or membrane to damp deck surface.

C. Do not expose materials subject to water or solar damage in quantities greater than can be weatherproofed during same day.

D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank one (1) inch cap nails, or screws and plates at a rate of one (1) fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 feet on center. for slopes less than 3:12 and four (4) feet on center. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install four (4) additional fasteners at the upper edge of the membrane when strapping the plies.

1.11 SEQUENCING AND SCHEDULING

A. Sequence installation of roofing with related units of work specified in other Sections to ensure that roof assemblies, including roof accessories, flashing, trim

and joint sealers, are protected against damage from effects of weather, corrosion and adjacent construction activity.

1.12 WARRANTY

A. Upon completion of installation, and acceptance by the Owner, the Manufacturer will supply to the Owner a 30 year No Dollar Limit Edge to Edge warranty, this warranty must cover all roofing, walls, flashings, metal edge, coping, and transitions in between each roof section. Warranty must be non-prorated and must cover all labor and all materials installed from the deck up. No renewals can be included, must be a full 30-year warranty.

B. Installer will submit a five (5) year warranty to the membrane manufacturer with a copy directly to Owner to include installation of all components of the roofing system, including insulation and all metal flashing work.

C. Same roofing manufacturer must warranty all built up roofing, metal roofing, and metal wall panels including all transitions.

PART 2 — PRODUCTS

2.1 PRODUCTS, GENERAL

A. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

B. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance the following and must include all items from Section 1.4 and 1.6.

1. Proposals shall be accompanied by a copy of the manufacturer's standard specification Section. That specification Section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.

2. Include a list of three (3) projects of similar type and extent, located within a one-hundred-mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by Owner or Owner's Representative.

3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance. A spread sheet comparing all items will need to be submitted with substitution request.

4. The District's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

5. All substitution requests must be submitted 10 days before bids are due. This allows for all bidders the chance to bid the same substituted product

and offers all bidders a fair bidding field. All substitutions submitted after this period will be rejected.

2.2 ACCEPTABLE MANUFACTURERS

A. The basis of design is roofing systems engineered and manufactured by The Garland Company or District approved equal:

The Garland Company
3800 East 91st Street
Cleveland, Ohio 44105
Steve Lampman (949) 322-1770
Pete Cochran (949) 295-0447
Website: www.garlandco.com

2.3 DESCRIPTION

A. (MBIT-1) Modified bituminous roofing work including but not limited to:

1. Type II base sheet: HPR Glasbase

2. Minimum two (2) plies of HPR Glasfelt, ASTM D2178, Type IV glass fiber roofing felt bonded to prepared substrate with hot bitumen;

2. Hot Bitumen: Trumbull, lo-odor Type III steep asphalt having the following characteristics:

a. Softening Point 185°F - 205°F

b. Flash Point 500°F

c. Penetration @ 77°F 15-35 units

d. Ductility @ 77°F 2.0 cm

3. Base Flashing Ply: For base flashings and target sheets; One (1) ply of Stressply EUV; 115 mil SBS and SIS (Styrene-Butylene-Styrene and Styrene-Isoprene-Styrene) rubber modified roofing membrane incorporating post consumer recycled rubber, fire retardant characteristics and reinforced with a fiberglass and polyester composite scrim set in hot asphalt and covered by an additional layer of torch applied modified bitumen mineral surface (Stressply IV UV Plus Mineral) 195 mil membrane.

4. Modified Base Flashing Capsheet Membrane: Stressply IV UV Plus Mineral; 195 mil SBS (Styrene-Butadiene- Styrene) mineral surfaced rubber modified roofing membrane with a fiberglass and polyester composite scrim. This membrane is designed for torch applications and has a burn-off backer that indicates when the material is hot enough to be installed. Title 24 compliant with no factory or field coating applied, Title 24 surface to be bright white minerals

5. Modified Mineral Surface Capsheet Field Membrane: Stressply Plus FR Mineral - Environmentally Friendly; 155 mil SBS (Styrene-Butylene-Styrene) rubber modified roofing membrane incorporating recycled rubber, fire retardant characteristics and reinforced with a fiberglass and polyester composite scrim covered by an additional layer of mineral surface modified bitumen membrane.

6. Surfacing: Apply White Star on all field sections, embed 300lbs per square of white Title 24 gravel as specified immediately while wet.

2.4 BITUMINOUS MATERIALS

A. Asphalt Primer: Garla Prime; V.O.C. compliant, ASTM D41.

B. Roofing Mastic: Flashing Bond, ASTM D 4586, Type II, Class I

C. Interply Adhesive: ASTM D312, Type III, low odor

2.5 SHEET MATERIALS

A. Felt Plies: HPR Glasfelts, ASTM D2178, Type IV

B. Modified Base Flashing Torch Capsheet Membrane Properties (Finished Membranes): Stressply IV UV Plus Mineral; ASTM D6162, Type III Grade G

1. Tensile Strength (ASTM D5147)
   a. 2 in/min. @ 73.4 ± 3.6°F MD 310 lbf/in CMD 310 lbf/in
2. Tear Strength (ASTM D5147)
   a. 2 in/min. @ 73.4 ± 3.6°F MD 510 lbf CMD 510 lbf
3. Elongation at Maximum Tensile (ASTM D5147)
   a. 2 in/min. @ 73.4 ± 3.6°F MD 6.0% CMD 6.0%
4. Low Temperature Flexibility (ASTM D5147): Passes -40°F
5. Title 24 compliant with no factory or field coating applied, Title 24 surface to be bright white minerals

C. Modified Mineral Surface Capsheet Field Membrane; Properties (Finished Membranes): Stressply Plus FR Mineral; ASTM D6162, Type III Grade G

1. Tensile Strength (ASTM D5147)
   a. 2 in/min. @ 73.4 ± 3.6°F MD 310 lbf/in CMD 310 lbf/in
2. Tear Strength (ASTM D5147)
   a. 2 in/min. @ 73.4 ± 3.6°F MD 500 lbf CMD 500 lbf
3. Elongation at Maximum Tensile (ASTM D5147)
   . 2 in/min. @ 73.4 ± 3.6°F MD 3.5% CMD 3.5%
4. Low Temperature Flexibility (ASTM D5147): Passes -30°F
5. Pre consumer recycled content 11%
6. Post consumer recycled content 0.3%

D. Modified Base Flashing Ply Membrane: Properties (Finished Membranes): Stressply EUV; ASTM D6162, Type III

1. Tensile Strength (ASTM D5147)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 700 lbf/in CMD 750 lbf/in

2. Tear Strength (ASTM D5147)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 1300 lbf CMD 1400 lbf

3. Elongation at Maximum Tensile (ASTM D5147)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 6.0% CMD 6.0%

4. Low Temperature Flexibility (ASTM D5147): Passes -30°F

2.6 SURFACINGS

A. Polyurea Flood Coat Adhesive: White Star; one-component, flexible, low odor, polyurea roof adhesive top coat. Performance Requirements:

1. Non-Volatile Content ASTM D2369 89%
2. Density @ 77 degrees F: 10.14 lbs/gal
3. Tensile Strength (ASTM D412) 2300-2600 psi
4. Tear Strength (ASTM 230-280 lbs./in.)
5. Elongation (ASTM D 412) 250-300%
6. Flash point ASTM D93 120 degrees F
7. Reflectance 88%
8. SRI 112

B. Roofing gravel surface to be 300lbs per square of bright white Title 24 gravel.

2.7 RELATED MATERIALS

A. Flashing and Sheet Metal: Kynar Coated, steel.

1. Coordinate with Section 07 60 00, to be provided by roofing membrane manufacturer to qualify for specified Manufacturer's edge-to-edge 30 year NDL warranty.

B. Nails and Fasteners: Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel. Fasteners shall be self-clinching type of penetrating type as recommended by the manufacturer of the deck material. Nails and fasteners shall be flush-driven through flat metal discs of not less than one (1) inch diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than one (1) inch diameter are used.

C. Metal Discs: Flat discs or caps of zinc-coated sheet metal not lighter than twenty eight (28) gauge and not less than one (1) inch in diameter. Form discs to prevent dishing. Bell or cup shaped caps are not acceptable.

D. Walkway Pads: Walkpads by WR Meadows; Factory formed, nonporous, with a slip-resisting surface texture, manufactured specifically for adhering to modified bituminous membrane roofing as a protection course for foot traffic, of the following thickness:

1. 1/2" thick.

2. To be installed around roof hatch and around all units unless shown in more locations on plans.

E. Walkway Pad Adhesive: Flashing Bond mastic.

F. Glass Fiber Cant: Continuous triangular cross Section made of inorganic fibrous glass used as a cant strip as recommended by the membrane manufacturer.

G. Drain Flashings and pipe jacks: ZincJak; should be new lead free soft sheet zinc formed and rolled. ZincJak info: zincjac@com-innov.com, 888-744-3439

1. Density 0.258 lbs/in
2. Melting point 786 degrees F
3. Tensile Strength (ksi) 10-22

H. Insulation: Match polyisocyanurate foam board roof insulation as specified in Section 075400 – Thermoplastic Membrane Roofing with thickness and slopes as indicated on Drawings. ***ADD-3***

PART 3 — EXECUTION

3.1 EXECUTION, GENERAL

A. Comply with requirements of Division 01 Section "Common Execution Requirements."

3.2 EXAMINATION

A. Verify that deck surfaces and project conditions are ready to receive work of this Section.

B. Verify that deck is supported and secured to structural members.

C. Verify that deck is clean and smooth, free of depressions, projections or ripples, and is properly sloped to drains.

D. Verify that adjacent roof substrate components do not vary more than ¼ inch in height.

E. Verify that deck surfaces are dry

F. Verify that openings, curbs, pipes, conduit, sleeves, ducts, and other items which penetrate the roof are set solidly, and that cant strips, wood nailing strips, and reglets are set in place.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.

B. Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.

C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of the modified bituminous roofing system.

D. Coordinate installation of roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut-offs at end of each day's work to cover exposed ply sheets and insulation with two (2) plies of #15 organic roofing felt set in full moppings of bitumen and with joints and edges sealed with roofing cement. Remove cut-offs immediately before resuming work.

E. Asphalt Bitumen Heating: Heat and apply bitumen in accordance with the Equiviscous Temperature (EVT) Method as recommended by National Roofing Contractors Association (NRCA). Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5°F at point of application) more than one (1) hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either from information by manufacturer or by suitable test. Do not exceed recommended temperature limits during bitumen heating. Do not heat to a temperature higher than twenty-five degrees (25°F) below flash point. Discard bitumen that has been held at temperature exceeding Finishing Blowing Temperature (FBT) for more than three (3) hours. Keep kettle lid closed except when adding bitumen.

F. Asphalt Bitumen Mopping Rate:

1. Interply Mopping: Apply bitumen at the rate of approximately twenty-five (25) lb.(11.3kg) of bitumen per roof square.

2. Modified Membrane Mopping: Apply bitumen at the rate of approximately thirty (30) lb (13.6kg). of bitumen per roof square.

G. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

H. Apply roofing materials as specified by manufacturer's instructions.

1. Keep roofing materials dry before and during application.

2. Complete application of roofing plies, modified sheet and flashing in a continuous operation.

3. Begin and apply only as much roofing in one day as can be completed that same day.

I. Cut-Offs (Waterstops): At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and insulation. Provide temporary covering of two (2) plies of #15 organic roofing felt set in full moppings of bitumen with joints and edges sealed.

J. Broadcast minerals into the bleed out of bitumen while bitumen is at its recommended EVT temperature to achieve uniform color throughout.

3.4 FELT PLY INSTALLATION

A. Fiberglass Plies: Install two (2) fiberglass ply sheets in twenty-five (25) lbs (11.3kg) per square of bitumen shingled uniformly to achieve two plies over the entire prepared substrate. Shingle in direction of slope of roof to shed water on each area of roof. Do not step on felt rolls until asphalt has cooled, fish mouths should be cut and patched.

B. Lap ply sheet ends eight (8) inches (203mm). Stagger end laps twelve (12) inches (304mm) minimum.

C. Lightly broom in fiberglass plies to assure complete adhesion.

D. Extend plies two (2) inches (50mm) beyond top edges of cants at wall and roof projections and equipment bases.

3.5 MODIFIED MEMBRANE APPLICATION

A. Solidly bond the modified membrane to the base layers with specified asphalt at the rate of thirty (30) lbs. (11-13kg) per 100 square feet.

B. The modified membrane roll must have asphalt slightly visible at all side laps. Exercise care during application to eliminate air entrapment under the membrane.

C. Apply pressure to all seams to ensure that the laps are solidly bonded to substrate.

D. Install subsequent rolls of modified membrane across the roof as above with a minimum of four (4) inch (101mm) side laps and eight (8) inch (203mm) end laps. Stagger the end laps. Apply the modified membrane in the same direction as the previous layers but stagger the laps so they do not coincide with the laps of the base layers.

E. Extend membrane two (2) inches (50mm) beyond top edge of all cants in full moppings of the specified asphalt.

3.6 FLASHING MEMBRANE INSTALLATION

A. Seal all curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.

B. Prime any concrete walls or curbs with 1 gallon per square of asphalt primer.

C. Install base flashing ply covering entire wall and wrapped over the top of the parapet wall, extended to outside edge of wall, with six (6) inches on to field of the roof and set in hot asphalt. Nail membrane at eight (8) inches on center.

D. Install a second ply of torch applied modified mineral surface base flashing capsheet membrane over the base flashing ply, nine (9) inches on to the field of the roof. Attach a termination bar attached every 16" on concrete walls and 8" on wood walls. Solidly adhere the entire sheet of flashing membrane to the substrate.

E. Coordinate counter flashing, cap flashings, expansion joints, and similar work with modified bitumen roofing work.

F. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work as specified in other Sections.

G. Coping Cap :

1. Prime vertical wall at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering entire wall and wrapped over top of wall to outside edge of exterior wall with six (6) inches on to field of the roof and set in hot asphalt. Nail membrane at eight (8) inches on center.

4. Install a torch applied modified mineral surface base flashing capsheet membrane over the base flashing ply, nine (9) inches on to the field of the roof.

5. Install coping cap with continuous outside clip and fasten on the inside edge every twenty-four (24) inches on center.

H. Equipment Support

1. Prime vertical concrete or gypsum board at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb with six (6) inches on to field of the roof.

4. Install torch applied modified mineral surface base flashing capsheet membrane over the base flashing ply, nine (9) inches on to the field of the roof. Attach top of membrane to top of curb and fasten at eight (8) inches o.c. where unit can not be lifted. Roof up and over entire curb of HVAC units unless unit is a downdraft unit. Replace pans with new 22ga fully soldered galvanized metal.

5. Install new slip metal under existing curbs with equipment that is not to be lifted. Fasten at twelve (12) inches on center with fasteners and neoprene washers. All joints in metal shall be sealed to be water tight. Replace pans completely with new where specified elsewhere in this specification.

I. Exhaust Fan

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb with six (6) inches on to field of the roof.

4. Install torch applied modified mineral surface base flashing capsheet membrane installed over the base flashing ply, nine (9) inches on to field of the roof. Attach top of membrane to top of curb and fasten at eight (8) inches on center.

5. Install metal exhaust fan over the fasteners and flashing to act as counterflashing. Fasten per manufacturer's recommendation.

J. Passive Vent/Air Intake

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb with six (6) inches on to the field of the roof.

4. Install torch applied modified mineral surface base flashing capsheet membrane installed over the base flashing ply, nine (9) inches on to field of the roof. Attach top of membrane to top of curb and attach at eight (8) inches on center.

5. Install passive vent/air intake over the fasteners and flashing to act as counterflashing. Fasten per manufacturers recommendations.

K. Roof Drain

1. Plug drain to prevent debris from entering plumbing.

2. Run roof system plies over drain. Cut out plies inside drain bowl.

3. Set zinc flashing (thirty (30) inch square minimum) in (¼) inch bed of mastic. Run zinc into drain a minimum of two (2) inches. Prime zinc at a rate of one hundred (100) square feet per gallon and allow to dry.

4. Install target sheet ply (forty (40) inch square minimum) in bitumen.

5. Install modified smooth membrane for field (forty-eight (48) inch square minimum) in bitumen.

6. Install clamping ring and assure that all plies are under the clamping ring.

7. On drain boxes, nail flange over target ply, staggered and primed. Do not create a dam at flange which would inhibit flow to drain. Run base plies short of drain and cap sheet to drain edge.

8. Install all new cast iron drain covers on all drains and overflows.

L. Plumbing Stack

1. Minimum stack height is twelve (12) inches.

2. Prime flange of new ZincJak flashing. Install properly sized ZinkJak set in (¼) inch bed of roof cement over roof plies.

3. Install target sheet ply in bitumen.

4. Install modified smooth membrane for field in bitumen.

5. Caulk the intersection of the membrane with elastomeric sealant.

6. Turn sleeve a minimum of one (1) inch down inside of stack or clamp at top, farrow out top edge, and seal with Tuff Stuff caulking.

M. Heat Stack

1. Minimum stack height is twelve (12) inches.

2. Prime flange of new sleeve. Install properly sized sleeves set in (¼) inch bed of roof cement over roof plies.

3. Install target sheet ply in bitumen.

4. Install modified smooth membrane for field in bitumen.

5. Caulk the intersection of the membrane with elastomeric sealant.

6. Install new collar over cape. Weld collar or install stainless steel draw brand.

3.7 APPLICATION OF SURFACING

A. Reflective Coating:

1. Allow all cold applied mastics and coating to properly dry and cure before installing the coating. Roof must be clean, free of dirt, dust, debris and dry.

2. Coat field of roof with two (2) gallons of cold process white polyrea (White star) and uniformly embed 300lbs of Title 24 bright white gravel into coating while wet.

3.8 FIELD QUALITY CONTROL

A. Perform field inspection and testing as required

B. Correct defects or irregularities discovered during field inspection.

C. A copy of the specification should also be on site at all times.

3.9 CLEANING

A. Remove bitumen adhesive drippings from all walls, windows, floors, ladders and finished surfaces.

B. In areas where finished surfaces are soiled by asphalt or any other sources of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning instructions and conform to their instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.10 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during roofing procedures. Comply with requirements of authorities having jurisdiction.

3.11 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. The roofing system manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor.

D. If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.

E. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. Notify the Owner upon completion of corrections.

G. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

H. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

END OF SECTION 075500

SECTION 078100
APPLIED FIREPROOFING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparation of substrates.
   2. Wet-mix sprayed fireproofing.
   3. Test data, literature and samples.
   4. Patching and repairs.
   5. Protection and cleaning.

B. Related Sections:
   1. Section 051200 - Structural Steel Framing.
   2. Section 053100 - Steel Decking.
   3. Section 078400 - Firestopping.
   4. Section 078443 – Fire-Resistant Joint Systems.
   5. Section 092900 - Gypsum Board.

1.2 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's specifications including certification from materials manufacturer required to show material compliance with Contract Documents.
   1. Submit U. S. Department of Labor Material Safety Data Sheets (MSDS) for hazardous materials used during Work of this Section.

A. Shop Drawings: Framing plans, schedules, or both, indicating the following:
   1. Extent of fireproofing for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of fireproofing after application.

B. Samples: Submit to Architect for review.
   1. Submit samples of cured fireproofing material, size 3-1/2 inch by 4-1/2 inch, in accordance with Section 013300.

C. Manufacturer's Certificates:
   1. Certification from manufacturer, stating that proposed material is free of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite, tremolite and asbestos contaminated vermiculite.
   2. Certification by manufacturers that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
   3. Fireproofing Product Certificates: Provide certificates from fireproofing manufacturer, for each fireproofing product required, indicating that:
      a. Steel to receive sprayed fireproofing should be unprimed; however, if it is primed, sprayed fireproofing manufacturer certify primers applied to steel in shop or field are compatible with sprayed-on fireproofing and will not impair its performance under fire exposure for applications indicated, as provided by ASTM E119 test. Include test and other data as evidence. Coordinate with structural steel Sections.
      b. Each fireproofing product complies with specified product requirements and is suitable for use indicated.
      c. Sprayed fireproofing has been completed in accordance with requirements to provide necessary fire resistance ratings. Provide Ratings Certificate.

4. Manufacturer Letter: Verifying that the UL Designs selected for the project are not load restricted.

D. Test Data: Submit laboratory test results for sprayed fireproofing for following, upon request.
   1. Corrosion Resistance per Military Specification MIL-E-5272C and ASTM E937.
   2. Deflection per ASTM E759.
   3. Bond Impact per ASTM E760.
   4. Compressive Strength per ASTM E761.
   5. Bond Strength per ASTM E736.
   6. Air Erosion per ASTM E859.
   7. Surface Burning Characteristics per ASTM E84.
   8. Indentation Hardness per ASTM C569.
   9. Dry Density per ASTM E605.
   10. Definition of Cementitious Materials - UL.

E. Laboratory Test Reports and Engineering Studies: Submit in accordance with ASTM E119, indicating fire endurance as required to satisfy codes or other requirements. Extracts of classified listings of such tests performed by Underwriters Laboratories, Inc. (ULI) of Northbrook, Illinois, or Underwriters Laboratories of Canada (ULC) of Scarborough, Ontario, Canada, are acceptable.
   1. Test results from independent testing laboratory indicating compliance of sprayed-on fireproofing products with performance requirements indicated, including asbestos content where applicable. Density requirements should be tested in accordance with the Displacement method per AWCI Tech Manual 12-A, 5.4.5.
   2. Test results of in-place performance as required under Part 3 of this Section for field quality control.

1.3 QUALITY ASSURANCES

A. Single Source Responsibility: Obtain wet-mix sprayed-on fireproofing materials (SFRM) from single manufacturer for each different product required.

B. Fireproofing Installer: Licensed, qualified, experienced and approved by manufacturer to apply fireproofing materials as specified. Applicator to have been in continuous business for not less than the past 5 years. Applicator shall provide, in writing, names of previous projects, comparable in type and size, successfully completed on time.

C. Testing Agency:
   1. Testing Laboratory Qualifications: Independent testing laboratory shall demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E-699, that has experience and capability to conduct satisfactorily testing indicated without delaying progress of the Work.
   2. Perform inspection and testing to ensure that applied thickness and density meets fire rating requirements, and verify that installation meets reviewed test reports. Initial inspection and testing shall be paid for by Owner.

D. Assemblies: Restrained and Unrestrained Assemblies Criteria for floor/ceiling and roof/ceiling assembly ratings shall comply with ANSI/UL 263. Provide fire resistance ratings for use in unrestrained conditions unless otherwise indicated.

E. Performance Criteria:
   1. Sprayed Fireproofing: Test by Underwriters' Laboratories in accordance with ASTM E119. Protect structural steel members except those encased in concrete with adequate fireproofing thickness and densities to provide fire resistance ratings as indicated.
   2. Apply materials in accordance with ASTM E84.
   3. Dry Density: Measure field density in accordance with ASTM E605 and displacement method per AWCI Tech Manual 12-A, 5.4.5. Minimum average density as listed in UL Fire Resistance Directory, ICBO Evaluation Report as required by authority having jurisdiction.
   4. Deflection: Material shall not crack, spall or delaminate from surface to which it is applied when tested in accordance with ASTM E759.
   5. Bond Impact: Material subject to impact tests in accordance with ASTM E760 shall not crack or delaminate from surface to which it is applied.

6. Bond Strength: Fireproofing, when tested in accordance with ASTM E736, shall have minimum average bond strength of 200 psf.
7. Air Erosion: Maximum allowable weight loss of fireproofing material of 0.005 gpm/ft^2 when tested in accordance with ASTM E859.
8. Compressive Strength: Fireproofing shall not deform more than 10 percent when subjected to compressive forces of 6.9 psf when tested in accordance with ASTM E761.
9. Corrosion Resistance: Test steel with applied fireproofing in accordance with ASTM E937; no corrosion of steel.
10. Abrasion Resistance: No more abrasion or removal than 22 cm^3 from fireproofing substrate when tested in accordance with test methods developed by city of San Francisco, Bureau of Building Inspection, and required by U.S. Navy (NAVFAC).
11. Impact Penetration: No loss of more than 6 cm^3 of fireproofing material when subjected to impact penetration tests in accordance with test methods developed by City of San Francisco, Bureau of Building Inspection, and required by U.S. Navy (NAVFAC).
12. Surface Burning Characteristics ASTM E84:
    a. Flame Spread: 0.
    b. Smoke Development: 0.
13. Resistance to Mold: Formulate fireproofing materials (SFRM) at time of manufacturing with mold inhibitor. Test fireproofing material in accordance with ASTM G21. Material shall show resistance to mold growth when inoculated with aspergillus niger and mixed spore cultures (Tappi T487-M54 and ASTM G21).

F. Codes and Regulations:
1. Supplement this specification by applicable requirements of Building Code and authorities having jurisdiction. Refer conflicts and discrepancies between Contract Documents and ordinances to Architect's attention.

G. Reference Standards:
1. American Society for Testing and Materials (ASTM):
    a. ASTM E84 Surface Burning Characteristics of Building Materials.
    b. ASTM E119 Fire Tests of Building Construction and Materials.
    c. ASTM E605 Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members.
    d. ASTM E736 Cohesion/Adhesion of Sprayed Fire-Resistive Material Applied to Structural Members.
    e. ASTM E759 Effect of Deflection of Sprayed Fire-Resistive Material Applied to Structural Members.
    f. ASTM E760 Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
    g. ASTM E761 Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
    h. ASTM E859 Air Erosion of Sprayed Fire-Resistive Material Applied to Structural Members.
2. Federal Specification (FS)
    a. SS-S-111B Sound Controlling Materials (Trowel and Spray Applications).
3. Military Specification (MIL)
    a. MIL-E-5272C Humidity Test, Procedure III.
4. California Building Code Standard (CBC)
    a. Thickness, Density Determination and Cohesion/Adhesion For Spray-Applied Fire-Resistive Fireproofing.
5. Underwriters' Laboratories, Inc. (UL).
    a. Building Materials Directory.
6. Occupational, Safety and Health Act (OSHA).

H. Mock-Up:
1. Apply typical sample section of not less than 10 square feet to representative substrate on site for review and to establish requirements of fire ratings and finish texture. Comply with project requirements as to thickness, density of application, and fire rating.
2. Examine installation within 24 hours of application to determine variance due to shrinkage, temperature, and humidity. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary.

a. Provide 2 bond strength tests in accordance with ASTM E736.
b. Provide 2 dry density tests in accordance with ASTM E605.
c. Mock-up may not remain as part of work.

1.4 DELIVERY, STORAGE AND HANDLING

A. Package materials in sturdy moisture-proof packages and deliver to project properly marked and labeled to show manufacturer's name, brand and certification of compliance with requirements for fire hazard, fire resistance classification, date of manufacture and shelf life.

B. Keep material dry until ready for use, off ground under cover and away from sweating walls and other damp surfaces. Discard bags that have been exposed to water or moisture. Use material before its expiration date.

1.5 PROJECT CONDITIONS

A. Ensure structure and surface to which sprayed fireproofing is applied, is not enclosed and is open to view until application is reviewed.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply spray fireproofing when temperature of substance material and surrounding air are below manufacturer's application recommendations.

1.7 PROTECTION

A. Provide ventilation in areas to receive fireproofing during and 24 hours after application, to maintain non-toxic, unpolluted safe work area.

B. Protect adjacent surfaces and equipment from damage by overspray fall-out, and dusting. Mask adjacent work as required.

C. Provide temporary enclosure to prevent spray from contaminating air.

D. Close off and seal duct work in areas where fireproofing is applied.

E. Protect applied sprayed fireproofing from damage.

1.8 SEQUENCING AND COORDINATION

A. Sequence and coordinate application of sprayed-on fireproofing with other related work specified in other Sections to comply with following requirements:

1. Provide temporary enclosures to prevent deterioration of sprayed-on fireproofing for interior applications due to exposure to unfavorable environmental conditions.
2. Avoid unnecessary exposure of sprayed-on fireproofing to abrasion and other damage likely to occur during construction operations subsequent to its application.
3. Do not apply fireproofing to metal roof decking substrates until application of roofing system has been completed; prohibit roof traffic during application and drying of fireproofing.
4. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, tested, and corrections made to defective fireproofing.

1.9 WARRANTY

A. Manufacturer and installer of applied fireproofing shall provide warranty stating applied fireproofing will remain free from cracks, checking, dusting, flaking, spalling, separation and blistering for minimum period of 2 years. Completely remove and reapply cracked fireproofing to satisfaction of Owner at no additional cost.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

A. Sprayed-on Fire-resistant Coating: Cementitious fireproofing, Wet-mix setting based type as defined by Underwriters Laboratories and free from asbestos, actinolite, amosite, anthophyllite, chrysotile and tremolite. No mineral fiber fireproofing allowed.

1. Cementitious Wet Mix Admixtures: Materials (with and without aggregate) which, when mixed in accordance with accompanying instructions forms a slurry or mortar providing properties necessary for conveyance and application to building structures.
2. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Steel members are to be considered unrestrained unless specifically noted otherwise.
   b. UL design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor are not allowed.
3. VOC Content: Products shall comply with VOC

2.2 MATERIALS

~~A. (FP-1): Provide standard density material meeting or exceeding 15 pounds per cubic foot per ASTM E605, no fungal growth per ASTM G21. For concealed locations and in plenum ceilings and above suspended ceilings.~~

~~1. Monokote MK-6 by Grace Construction Products.~~
~~2. Pyrolite 15 by Carboline Fireproof Products Division.~~
~~3. Cafco-300 by Isolotek.~~
~~4. Southwest Fireproofing Type 5GP by AD Fire Protection Systems.~~ ***ADD-3***

B. (FP-2): Provide medium density material meeting or exceeding 22 pounds per cubic foot per ASTM E605, no fungal growth per ASTM G21 and also containing 50 percent cement content by weight minimum. For exterior concealed areas, exposed locations on columns, beams, and roof deck in mechanical and electrical rooms, penthouses, data rooms, elevator rooms and shafts, non-ducted air shafts, equipment rooms, and other service type rooms and where indicated.

1. Grace Construction Products, Monokote Z-106.
2. Pyrolite 22 by Carboline Co., Fireproofing Products Division.
3. Carboline Co., Fireproofing Products Div.; Pyrocrete 239.
4. Isolatek International Corp.; Cafco 400.
5. Pyrok-MD by Pyrok, Inc.
6. Southwest Fireproofing Type 5MD by AD Fire Protection Systems.

~~C. (FP-3): Provide high density material meeting or exceeding 40 pounds per cubic foot per ASTM E605, no fungal growth per ASTM G21 and also containing 50 percent cement content by weight minimum. For exterior locations, new and existing canopy structure, including columns, high impact resistance locations, high humidity areas, including swimming pool areas, and where indicated.~~

~~1. Grace Construction Products, Monokote Z-146.~~
~~2. Fendolite M-II by Isolotek.~~
~~3. Pyrocrete 40 by Carboline Co., Fireproofing Products Division.~~
~~4. Pyrok, Inc.; Pyrok-HD.~~
~~5. Southwest Fireproofing Type 1XR by AD Fire Protection Systems.~~ ***ADD-3***

2.3 MATERIALS

A. Sprayed-on Fire-resistant Coating: Wet-mix setting based type as defined by Underwriters Laboratories and free from asbestos, actinolite, amosite, anthophyllite, chrysotile and tremolite.

1. Wet Mix Admixtures: Materials (with and without aggregate) which, when mixed in accordance with accompanying instructions forms a slurry or mortar providing properties necessary for conveyance and application to building structures.

B. Water: Potable, fresh and free from organic and mineral impurities which would affect set of sprayed fireproofing materials.

2.4 AUXILIARY FIREPROOFING MATERIALS

A. Auxiliary Fireproofing Materials: Provide type compatible with sprayed-on fireproofing products and substrate that are approved for use indicated by manufacturer of sprayed-on fireproofing, and are approved by nationally recognized testing laboratories or other testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance rated designs indicated.

B. Substrate Primers: Type approved by manufacturer of sprayed-on fireproofing for substrate and for conditions of exposure indicated.

C. Adhesive for Bonding Fireproofing: Type recommended by manufacturer of sprayed-on fireproofing manufacturer.

2.5 MIXING

A. Perform mixing and preparation of materials at project using mechanical equipment, in accordance with manufacturer's printed directions to achieve performance criteria specified herein.

PART 3 EXECUTION

3.1 AREA PREPARATION

A. Provide necessary measures for protection of workers and public, as required under regulation of U.S. Occupational Safety and Health Act (OSHA), and applicable local ordinances, and code regulations.

B. Provide protection for workmen applying fireproofing and for other workers who are in vicinity of application of mixing operations. Provide necessary measures for protection of general public and for prevention of air pollution as required. Enclose exterior openings at areas where spray application will be in progress.

C. Provide masking, drop cloths, or other satisfactory covering for materials which are not to receive fireproofing to prevent damage from contamination from overspray or fallout of materials.

3.2 EXAMINATION

A. Examine surfaces to which this work is to be attached or applied and notify Architect if conditions exist which are detrimental to proper and expeditious installation of work. Starting of work shall imply acceptance of substrate for adhesion and performance of work as specified. Substrate is in satisfactory condition if it complies with following :

1. Substrate complies with requirements of section in which substrate and related work is specified and is free of oil, grease, rolling compounds, incomplete primers, loose mill scale, dirt or other foreign substances capable of impairing bond of fireproofing with substrate under conditions of normal use or fire exposure.
2. Objects which will penetrate fireproofing, including clips, hangers, support sleeves and similar items have been securely attached to substrates.
3. Substrates are not obstructed by ducts, piping, equipment and other suspended construction that could interfere with application of fireproofing and until it has dried.

B. Cooperate with coordination and scheduling of work of this section with work of other sections so not to delay job progress.

C. Clips, hangers, supports, sleeves and other attachments to fireproofing bases, as covered under other sections of specifications, are to be placed by other trades prior to application of fireproofing material, where these materials can be anticipated in advance.

D. Ducts, piping or conduit or other suspended equipment that could interfere with uniform application of fireproofing material are to be positioned after application of sprayed fireproofing, unless fireproofing applicator agrees to their installation prior to fireproofing.

E. Prior to application of fireproofing material, ascertain that steel is acceptable to receive fireproofing. Steel shall be free of oil, grease, loose mill scale, or other substance that may impair proper adhesion.

3.3 SURFACE PREPARATION

A. Clean surface to receive sprayed fireproofing to remove mill scale, dirt, grime, oil, grease, dust, loose rust, rolling compounds, incompatible primers and other foreign material which will impair satisfactory bonding of fireproofing to substrate.

B. Cover other work which might be damaged by fallout or overspray of fireproofing materials during application. Provide temporary enclosure as may be required to confine operations, protect environment, and to ensure adequate ambient conditions for temperature and ventilation.

C. Notify Contractor of surface condition which cannot be corrected by normal cleaning methods and requires correction of conditions prior to application of sprayed fireproofing.

3.4 APPLICATION

A. Commencement of application of fireproofing shall be deemed as acceptance by applicator of suitability of surface to receive work and acceptance of responsibility for failure of bond between fireproofing and substrate.

B. Apply spray fireproofing using manufacturer's authorized installer in accordance with manufacturer's directions and instructions and in conformance with city and state codes, regulations and requirements having jurisdiction. Qualified manufacturer's representative shall be present for initial application to guide and assist applicator's personnel.

C. Sprayed Fireproofing: Apply to areas and surfaces which are scheduled to be fireproofed and to proper thicknesses to achieve fireproofing hours.

1. Control thickness of fireproofing by utilizing workable depth gauge to assure that minimum thickness has been applied.

D. Ventilation: Make provisions to properly dry fireproofing after application. In enclosed areas lacking natural ventilation, provide mechanical air circulation and ventilation.

E. Equipment, Mixing and Application: In accordance with manufacturer's written specification and application instructions. Mechanically control material and water ratio on project site.

F. Qualified Personnel: Provide to supervise application.

G. Bonding Adhesive: Apply to underside of steel roof deck units which do not have concrete topping and where required by appropriate UL Design. Bonding adhesive is optional in other conditions unless recommended by manufacturer of sprayed fire protection material (SFRM). Apply bonding adhesives in accordance with manufacturer's written application instructions.

H. Do not install fireproofing prior to completion of concrete work on steel pan stairs. Apply to underside of roof deck assemblies only after roofing system is complete and roof traffic has ceased.

I. Cracking: No cracking of fireproofing material allowed per UL requirements. Repair cracks at no additional cost to Owner by removing existing fireproofing and reapplying

3.5 PATCHING, REPAIRING, CLEANING AND PROTECTION

A. Perform patching and repairing of sprayed fireproofing, due to cutting by other trades, by fireproofing applicator. Work shall be paid for by trades that performed cutting, as directed and at no additional cost.

1. Coordinate installation of fireproofing with other work in order to minimize need for other trades to cut or remove fireproofing. As other trades successively complete installations of their work, maintain protection of structure's fireproofing by patching areas which have been removed or damaged prior to concealment of fireproofing by other work.

B. After completion of fireproofing work, remove equipment and clean walls, floors, equipment, pipes and conduit of over sprayed fireproofing materials.

C. Cleaning: Immediately upon completion of sprayed operations in each containable area, remove over-spray and fall-out materials from surfaces of other work and clean exposed surfaces to remove evidence of soiling.

D. Cure exposed wet-mix fireproofing materials in compliance with fireproofing manufacturer's recommendations to prevent premature drying.

E. Protect fireproofing according to advice of fireproofing manufacturer and installer from damage resulting from construction operations or other causes so that fireproofing will be without damage or deterioration at time of Substantial Completion.

3.6 FIELD QUALITY CONTROL

A. Testing and Inspection: Owner will engage qualified special inspectors in accordance with Section 014533.
   1. Qualifications: The minimum category of special inspector required to perform services outlined below are noted by qualifications in parentheses. The definitions of the categories of special inspector are included in Section 014533.

B. Contractor and sub-contractor for this Section shall cooperate with testing agency in furnishing samples for testing, and other testing agency procedures.
   1. Should tested fireproofing fail to meet performance criteria, remove fireproofing, reinstall and retest at no additional cost to Owner.
   2. Correct unacceptable work and pay for further testing required to prove acceptability of installation.
   3. Patch test areas as required to re-establish fireproofing integrity.

C. Testing agency shall be familiar with the requirements and testing methods required by applicable code sections and with approved UL assembly requirements.

D. Spray Applied Fireproofing: (Technical I)
   1. Procedures and Preparation: Verify substrates to receive fireproofing are prepared in accordance with manufacturer's instructions and are free of materials that may prevent adequate adhesion. Inspect batching to comply with manufacturer's requirements for first 3,000 SF applied. Select areas to be tested in accordance with IBC Section 1704.10.5.1 and 1704.10.5.2 and test per ASTM E 736. Bond strength shall not be less than 150 pounds per square foot when tested in accordance with the field test method of ASTM E 736.
   2. Thickness: Test thickness of applied fireproofing per frequencies per applicable code requirements. Test 25% of gross applied area on the structural frame, columns and beams of each building story in accordance with ASTM E 605. Take not less than four measurements for each 1000 square feet of sprayed area on each floor or part thereof per ASTM E 605 for beams and joists (other than structural frame members).
   3. Density: Test density per ASTM E 605 on 1 column, 1 beam and 1 deck or slab for each 10,000 SF (or fraction thereof), of floor or roof area, or from each level if the area is smaller than 10,000 SF.

END OF SECTION

SECTION 088000
GLAZING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Monolithic vision glass.
      a. Laminated glass.
   2. Insulated vision glass.
      a. Insulated laminated glass
      b. Insulated spandrel glass.
      c. Insulated laminated spandrel glass.
   3. Fire-rated glazing
   4. Accessories, glazing and setting materials.

B. Related Sections:
   1. Section 017325 - Seismic Restraint Requirements for Nonstructural Components
   2. Section 079000 – Joint Protection.
   3. Section 084113 – Aluminum Entrances and Storefronts: Glass stops and glazing gaskets.
   4. Section 084114 – Aluminum Interior Doors and Frames: Glass stops and glazing gaskets.
   5. Section 084400 – Aluminum Curtain Walls, Windows and Entrances: Glass and glazing in curtain wall, window and entrance system.
   6. Section 102813 – Toilet Accessories: Metal-framed mirror units.

1.2 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Deterioration of Coated Glass: Defects developed from normal use attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. Deterioration of Laminated Glass: Defects developed from normal use attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

E. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    a. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.
    b. Specified Design Seismic Loads: Determine design seismic loads applicable to Project, required by ASCE 7 and Section 017325
    c. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads."
    d. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
        1) Load Duration: 60 seconds or less.
    e. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
        1) For monolithic-glass lites heat treated to resist wind loads.
        2) For insulating glass.
        3) For laminated-glass lites.
    f. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
    g. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Seismic Movements: Glass in glazed curtain walls, glazed storefronts and glazed partitions shall meet relative displacement requirements to resist fallout as indicated in Section 017325 in accordance with ASCE 7, Section 13.5.9.

D. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F , ambient; 180 deg F, material surfaces.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch- wide interspace.
4. Center-of-Glass U-Values: NFRC 100 methodology using LBL WINDOW 6.3 computer program, expressed as Btu/ square foot x h x degree F.
5. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL WINDOW 6.3 computer program.
6. Solar Optical Properties: NFRC 300

1.4 APPLICABLE STANDARDS

A. Safety Glazing: Conform to Safety Standard for Architectural Glazing Materials (CPSC 16 CFR 1201). Tempered glass and wire glass shall conform to requirements of ANSI Z97.1, with permanent label in accordance with statutes.

B. ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation *(replaces ASTM E773, E774 CBA, CAN / CGSB 12.8)*Flat Glass: ASTM C 1036, Flat Glass. Flat Glass Marketing Association (FGMA) Glazing Manual.

C. Fire-Resistance-Rated Wire Glass: Provide wire glass products that are identical to those tested per ASTM E163 (UL 9) and are labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

D. Heat Treated Flat Glass: ASTM C 1048, Heat Treated Flat Glass.

E. Laminated Glass: ASTM C 1172 – Standard Specification for Laminated Architectural Flat Glass; Comply with applicable quality requirements for cut sizes of flat laminated glass consisting of two or more lites of glass bonded with interlayer material for use in building glazing.

1.5 SUBMITTALS

A. Product Data: Provide for structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

B. Shop Drawings:
   1. Review curtain wall and window shop drawings and submit acceptance of details as suitable for proposed glass products.

C. Calculations: Structural design shall be performed by a Professional Engineer, licensed in the state where Project is located. Signed engineering calculations shall be submitted to Architect/Engineer
   1. Structural design calculations are required per IBC Section 2403, for glass not supported on 4 sides, including glass supports and framing, indicating structural integrity of glass size, glass support members, anchors, fasteners and connections to building, in accordance with specified criteria.
   2. Structural design calculations for seismic design forces and relative displacements are required for glass in glazed curtain walls, glazed storefronts and glazed partitions in accordance with Section 017325.
   3. Engineering Responsibility: Calculations shall be reviewed for stated design assumptions, general compliance to specified requirements, and forces imposed on glass structure. The accuracy of the design calculations shall be the sole responsibility of the Contractor's Professional Engineer.

D. Samples: Submit samples of sandblasted/frosted, spandrel, decorative and wire glass, and glazing sealant, for color selection and appearance acceptance.

E. Insulating Glass Certification: Submit data verifying compliance with IGCC, Class A level.

F. Compatibility Certification: After testing and review, certify compatibility of materials in contact and in close proximity to glazing sealant materials.

G. Wind Pressure and Thermal Stress Analysis: Submit thermal stress analysis of glass where thermal stress may occur.

H. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

C. Single Source Responsibility: Provide materials obtained from one source for each type of insulating glass and glazing product indicated.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252

E. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

F. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
   1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:
   1. Insulating Glass Certification Council.

H. Mockups: Before glazing, build mockups for each glass product indicated below to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in the combination with curtain wall mockup requirements.
   2. Build mockups with the glass to match glazing systems required for Project, including typical lite size, framing systems, and glazing methods:
   3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   4. Obtain Architect's approval of mockups before starting fabrication.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Demolish and remove mockups when directed.

1.7 PRODUCT HANDLING

A. Deliver and store glass and glazing in manufacturer's protective covering. Handle glass and glazing with care to prevent damage.

1.8 PROJECT/SITE CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 GLASS WARRANTY

A. Warranty for Insulating Units: Warranty sealed insulating glass units for minimum period of ten (10) years, with manufacturer's replacement guarantee, covering as minimum: Defective or failure of seal; material vision obstruction as result of dust collection or film formation between panels or other similar failure and the following specific conditions:
   1. Reflective glass whose reflective coating cracks, peels or discolors shall be replaced at no charge (material only) for minimum ten (10) year period beginning on date of Substantial Completion.
   2. In addition to replacement of insulated units, provide removal and reinstallation of new units without cost to Owner during first five (5) years of guarantee.

B. Spandrel Glass Warranty: Spandrel glass whose opacifier delaminates, cracks, peels, wrinkles, discolors, or stains shall be replaced at no charge (material only) for minimum five (5) year period beginning on date of Substantial Completion.

C. Laminated Glass Warranty: Laminated glass that delaminates shall be replaced at no charge (material only) for minimum 5 years beginning on date of Substantial Completion.

D. Glazing installer shall coordinate glass and glazing installation with framing systems, and install glass and glazing in accordance with manufacturer's instructions, so that guarantee is maintained.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Glass Substrate:
   1. AFG Industries.
   2. ACH Float Glass Operations (Versalux)
   3. Guardian Industries.
   4. Pilkington.
   5. PPG Industries Glass Group.

B. Acceptable Fabricators for Insulated Glass Units:
   1. Any manufacturer/fabricator with "CBA" classification.

C. Acceptable Fabricators for Metallic Coated Units:
   1. Viracon Incorporated.
   2. Tempglass Eastern.
   3. PPG Industries Glass Group.

2.2 SINGLE GLASS

A. (GL-1) Clear Float Glass: 1/4 inch thickness; comply with ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).

B. (GL-1T) Clear Tempered Glass: 1/4 inch thickness; comply with ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), and further processed to comply with ASTM C1048, Kind FT (fully tempered).

2.3 MONOLITHIC BACK PAINTED GLASS

A. (GL-6) Back Painted Glass: LI BP Straight White (Lustre Finish) by GlassPro, 1/4 inch thickness.

B. (GL-7) Back Painted Glass: LI BP Yellow by GlassPro, 1/4 inch thickness

C. (GL-7T) Back Painted Tempered Glass: LI BP Yellow by GlassPro, 1/4 inch thickness

D. (GL-8) Back Painted Glass: LI BP True Fog White (Starphire) by GlassPro, 1/4 inch thickness.

E. (GL-8T) Back Painted Tempered Glass: LI BP True Fog White (Starphire) by GlassPro, 1/4 inch thickness. ***ADD-3***

2.4 LAMINATED MONOLITHIC GLASS

A. (GL-15) Laminated, Tempered Clear Glass: LI Super Red (Tempered) by GlassPro, 9/16 inch thick laminated, tempered glass. Edges ground smooth for exposed conditions.

2.5 INSULATING GLASS

A. (GL-21) Clear Low-E Insulated Glass Unit: One inch thick unit constructed of 1/4 inch clear heat strengthened exterior light, 1/2 inch air space using fabricators black warm edge spacer, and 1/4 inch clear heat strengthened interior. High performance low-emissivity coating on No. 2 surface and argon gas in cavities. Glass thickness and thickness of individual glass plies are minimum. One or both plies heat strengthened where required for wind pressure or thermal stress.
   1. Visible transmittance: 59 percent.
   2. Exterior reflectance: 27 percent.
   3. Shading coefficient: 0.43
   4. Nighttime Winter U-value: 0.30 BTU/hour/square foot maximum.
   5. Nighttime Summer U-value: 0.29 BTU/hour/square foot maximum.
   6. SHGC: 0.37
   7. LSG: 1.59
   8. Acceptable products:
      a. Viracon: Solarscreen 2000, VRE 1-65.
      b. Comparable product of other specified manufacturers.

B. (GL-21L) Clear Laminated Low-E Insulated Glass Unit: 1-1/16 inch thick laminated, insulated, low-e coated glass unit constructed of 1/4 inch clear ~~heat strengthened~~ tempered exterior light, 1/2 inch air space using fabricators black warm edge spacer, and 2 layers of 1/8 inch clear heat strengthened inboard light laminated with 0.060 inch clear PVB inner layer. High performance low-emissivity coating on No. 2 surface and argon gas in cavities. Glass thickness and thickness of individual glass plies are minimum. ***ADD-3***

1. Visible transmittance: 59 percent.
2. Exterior reflectance: 27 percent.
3. Shading coefficient: 0.43
4. Nighttime Winter U-value: 0.30 BTU/hour/square foot maximum.
5. Nighttime Summer U-value: 0.29 BTU/hour/square foot maximum.
6. SHGC: 0.37
7. LSG: 1.59
8. Acceptable products:
   a. Viracon: Solarscreen 2000, VRE 1-65.
   b. Comparable product of other specified manufacturers.

C. (GL-21T) Clear Tempered Low-E Insulated Glass Unit: One inch thick unit constructed of 1/4 inch clear tempered exterior light, 1/2 inch air space using fabricators black warm edge spacer, and 1/4 inch clear tempered interior. High performance low-emissivity coating on No. 2 surface and argon gas in cavities. Glass thickness and thickness of individual glass plies are minimum. One or both plies heat strengthened where required for wind pressure or thermal stress.

1. Visible transmittance: 59 percent.
2. Exterior reflectance: 27 percent.
3. Shading coefficient: 0.43
4. Nighttime Winter U-value: 0.30 BTU/hour/square foot maximum.
5. Nighttime Summer U-value: 0.29 BTU/hour/square foot maximum.
6. SHGC: 0.37
7. LSG: 1.59
8. Acceptable products:
   a. Viracon: Solarscreen 2000, VRE 1-65, tempered.
   b. Comparable product of other specified manufacturers.

D. (GL-23) Clear Insulated Coated Silkscreen, Low-E Insulated Glass Unit: One inch thick unit constructed of 1/4 inch clear heat strengthened exterior light with No. 5065 on No. 2 (V933 – Warm Gray Viraspan #2), 1/2 inch air space using fabricators black warm edge spacer, and 1/4 inch clear heat strengthened interior. High performance low-emissivity coating on No. 2 surface and argon gas in cavities. Glass thickness and thickness of individual glass plies are minimum. One or both plies heat strengthened where required for wind pressure or thermal stress.

1. Visible transmittance: 39 percent.
2. Exterior reflectance: 27 percent.
3. Shading coefficient: 0.31
4. Nighttime Winter U-value: 0.30 BTU/hour/square foot maximum.
5. Nighttime Summer U-value: 0.27 BTU/hour/square foot maximum.
6. SHGC: 0.27
7. LSG: 1.44
8. Acceptable products:
   a. Viracon: Solarscreen 2000, VRE 1-65 screened.
   b. Comparable product of other specified manufacturers.

F. (GL-23L) Clear Laminated Insulated Coated Silkscreen, Low-E Insulated Glass Unit: 1-1/16 inch thick laminated, insulated, low-e coated glass unit constructed of 1/4 inch clear ~~heat strengthened~~ tempered exterior light with No. 5065 on No. 2 (V933 – Warm Gray Viraspan #2), 1/2 inch air space using fabricators black warm edge spacer, and 2 layers of 1/8 inch clear heat strengthened inboard light laminated with 0.060 inch clear PVB inner layer. High performance low-emissivity coating on No. 2 surface and argon gas in cavities. Glass thickness and thickness of individual glass plies are minimum. One or both plies heat strengthened where required for wind pressure or thermal stress. ***ADD-3***

1. Visible transmittance: 39 percent.
2. Exterior reflectance: 27 percent.
3. Shading coefficient: 0.31
4. Nighttime Winter U-value: 0.30 BTU/hour/square foot maximum.
5. Nighttime Summer U-value: 0.27 BTU/hour/square foot maximum.
6. SHGC: 0.27
7. LSG: 1.44
8. Acceptable products:
   a. Viracon: Solarscreen 2000, VRE 1-65 screened.
   b. Comparable product of other specified manufacturers.

G. (GL-24T) Clear Tempered Low-E Insulated Glass Unit: 5/8 inch thick unit constructed of 5/16 inch clear tempered exterior light, 1/2 inch air space using fabricators black warm edge spacer, and 5/16 inch clear tempered interior. High performance low-emissivity coating on No. 2 surface and argon gas in cavities. Glass thickness and thickness of individual glass plies are minimum. One or both plies heat strengthened where required for wind pressure or thermal stress.

1. Acceptable products:
   a. International Green House, clear tempered Low-E insulated.
   b. Comparable product of other specified manufacturers.

2.6 SPANDREL GLASS

A. (GL-41) Insulated Tinted Spandrel Glass Units: One inch thick tinted insulated glass unit, 1/4 inch tinted outboard light with Viraspan V908 #2, 1/2 inch air space using fabricators warm edge spacer, 1/4 inch clear VE-48 #4 inboard light (ceramic coating on the fourth surface).

1. Nighttime Winter U-value: 0.31 BTU/hour/square foot maximum.
2. Nighttime Summer U-value: 0.29 BTU/hour/square foot maximum.
3. Product:
   a. Viracon: Solarscreen VE 1-48 tinted, glass, with ceramic frit.

B. (GL-41L) Insulated Laminated Tinted Spandrel Glass Units: 1-1/16 inch thick laminated tinted insulated glass unit, 1/4 inch tinted, tempered outboard light with Viraspan V908 #2, 1/2 inch air space using fabricators warm edge spacer, 2 layers of 1/8 inch clear VE-48 #4 inboard light laminated with 0.060 inch clear PVB inner layer (ceramic coating on the fourth surface). ***ADD-3***

1. Nighttime Winter U-value: 0.31 BTU/hour/square foot maximum.
2. Nighttime Summer U-value: 0.29 BTU/hour/square foot maximum.
3. Product:
   a. Viracon: Solarscreen VE 1-48 tinted, glass, with ceramic frit.

C. (GL-41T) Insulated Tinted Tempered Spandrel Glass Units: One inch thick tinted tempered insulated glass unit, 1/4 inch tinted tempered outboard light with Viraspan V908 #2, 1/2 inch air space using fabricators warm edge spacer, 1/4 inch clear tempered VE-48 #4 inboard light (ceramic coating on the fourth surface).

1. Nighttime Winter U-value: 0.31 BTU/hour/square foot maximum.
2. Nighttime Summer U-value: 0.29 BTU/hour/square foot maximum.
3. Product:
   a. Viracon: Solarscreen VE 1-48 tinted, glass, with ceramic frit.

D. ~~(GL-41TL) Insulated Laminated Tinted Tempered Spandrel Glass Units: 1-1/16 inch thick laminated tinted tempered insulated glass unit, 1/4 inch tinted tempered outboard light with Viraspan V908 #2, 1/2 inch air space using fabricators warm edge spacer, 2 layers of 1/8 inch clear tempered VE-48 #4 inboard light laminated with 0.060 inch clear PVB inner layer (ceramic coating on the fourth surface).~~

1. ~~Nighttime Winter U-value: 0.31 BTU/hour/square foot maximum.~~
2. ~~Nighttime Summer U-value: 0.29 BTU/hour/square foot maximum.~~
3. ~~Product:~~
   a. ~~Viracon: Solarscreen VE 1-48 tinted, glass, with ceramic frit~~. ***ADD-3***

2.7 FIRE-RATED GLAZING

A. (GL-62) Laminated Ceramic Glazing: Proprietary product in the form of two lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft.; and as follows:
   1. Fire-Protection Rating: 45 min. rated, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Polished on both surfaces, transparent.
   3. Product: Subject to compliance with requirements, provide "FireLite Plus" manufactured by Nippon Electric Glass Co., Ltd. and distributed by Technical Glass Products.
   4. Other Acceptable Manufacturer: Vetrotech Saint-Gobain.

B. (GL-63) Laminated Glass with Intumescent Interlayers: Proprietary product in the form of multiple lites of Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Kind FT (fully tempered) float glass laminated with intumescent interlayers to produce a laminated lite of 1-5/8-inch nominal thickness; and as follows:
   1. Fire-Protection Rating: 60 min. rated, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Product: Subject to compliance with requirements, provide "Pilkington Pyrostop 60-361" distributed by Technical Glass Products.
   3. Other Acceptable Manufacturer: Vitrotech Saint-Gobain, or District approved equal.

2.8 ACCESSORIES

A. Framing for Butt Glazing: Aluminum or stainless steel angles as indicated. Anchor to ceiling and floor substrates with appropriate fasteners in locations as indicated.

B. Setting Blocks: 100% silicone with a durameter hardness of 85±5, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.

C. Spacers and Shims: 100% silicone with a durameter hardness of 85±5, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.

D. Glazing Tape: Butyl or silicone preshimmed tape similar to Tremco 440 Tape.

2.9 EXTERIOR GLAZING

A. Glazing gaskets, sealant backers within glazing pockets, and continuous glass spacer pads at structural silicone shall be black heat cured silicone rubber conforming to ASTM C1115-00, Type C. Norton V2100 Thermalbond Tape is acceptable as a glass spacer pad when used in conjunction with structural silicone.

B. Gaskets for dry glazed system shall be silicone, EPDM, neoprene or Santoprene. Sponge gaskets shall be extruded black neoprene with hardness of 40 +/- 5 durometer Shore A and conforming to ASTM C 509-00. Design sponge gaskets to provide 20% to 35% compression. Dense gaskets shall be black extrusions with Shore A hardness of 75 +/- 5 for hollow profiles and 60 +/- 5 for solid profiles, and conforming to ASTM C1115-00, Type C or to ASTM C 864-99. Injection mold corners of gaskets where compatible with installation procedures.

C. Structural Glazing System:
   1. Sealant: GE Ultraglaze SSG 4000 by General Electric or 795 by Dow Corning. Verify compatibility of sealant with secondary seal of dual seal insulating glass system.

2. Maximum design stress on Structural Silicone Sealant shall not exceed 20 ps

2.10 INTERIOR GLAZING

A. Type and Manufacturer: Mono one-part acrylic-terpolymer sealant or Proglaze silicone sealant by Tremco, color as selected from manufacturers standard colors.

B. Other Acceptable Manufacturers: General Electric, DAP, PTI, Pecora.

C. Fire-Rated Glazing System: As recommended by fire-rated glass manufacturer.

D. Butt Glazing System: Tremco silicone structural "butt" glazing system, color as selected from manufacturer's standard range.

2.11 FABRICATION

A. Heat-Treated Float Glass: ASTM C 1048. Fabricate using horizontal roller heating process only. Roll wave distortion parallel to bottom edge of glass as installed. Deviation from flatness at any peak (peak to valley deviation): shall not exceed 0.003 inches in the center of a lite and shall not exceed 0.008 inches within 10.5 inches of the leading or trailing edge.

B. Insulating Glass Units:

1. Fabricate using both primary and secondary seals and as otherwise required to comply with the IGCC CBA classification.
2. Fabricate using glass from the same manufacturer throughout the Project.
3. Seal Construction: Dual seal design with primary seal of PIB and Silicone Secondary Seal, unless specifically indicated otherwise.

A. Edge Finishing: Fabricate finished edges to produce smooth, polished edges without chips, scratches, or warps.

1. Non-Exposed Finished Edge, Typical: Flat polished.
2. Butt-Glazed Lites: Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
3. Exposed Edges: Grind smooth and polish exposed glass edges and corners, unless noted otherwise.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify glazing channels are free of burrs, irregularities, and debris.
2. Verify glass is free of edge damage or face imperfections.
3. Inspect door and frames to determine that frames, sash, and stops are set true and straight. Sash rabbets and stops shall be clean and dry at time of glazing.
4. Do not proceed until unsatisfactory conditions have been corrected.

B. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Provide glass manufacturer's recommended edge clearances when sizing glass.

B. Remove protective coatings from surfaces to be glazed.

C. Clean glass and glazing surfaces to remove dust, oil, and contaminants, and wipe dry.

D. Verify measurements of sash and openings at Project.

1. Dimensions shown or indicated are given only as a guide for estimating purposes, and actual size shall be determined by measurement of the actual openings. Accurately cut glass to fit openings with proper clearances and setting block height.

E. Coordinate with and check Shop Drawings furnished by other suppliers of Work affecting this Section to avoid field installation problems.

F. Before glazing metal sash, remove oil, lacquer, or other material to which the compound will not readily adhere or which will tend to delaminate from metal and cause a leak through the glazing seal.

3.3 INSTALLATION

A. Comply with glass fabricators recommendations.

B. Except where curtain wall, window, entrance or glass manufacturer recommends otherwise, comply with Flat Glass Marketing Association (FGMA) Sealant Manual and FGMA Glazing Manual.

C. Glaze insulated units as recommended by glass and frame manufacturers.

D. Do not apply glazing materials at temperatures below manufacturer's recommendations or to damp or frosted surfaces. Apply glazing material according to the manufacturer's instructions using proper primers as required.

E. Set glass using neoprene setting blocks and spacers to insure proper edge clearance and uniform beads of compound. Clearances shall conform to FGMA Glazing Manual requirements. Center glass in glazing rabbets.

1. Butt glazing requirements: Apply mildew resistant silicone sealant to flush depth of joint as indicated by sealant manufacturer.

F. Check openings to confirm proper clearance at perimeters and between glass and stops.

1. Clean surfaces of rabbet (including stops) and surface of glass which will come into contact with sealant. Use solvents and methods which insure clean, dry surfaces without film or foreign material when sealant is placed.

G. Remove and replace glazing beads carefully to avoid marking or defacing any portion of frame, sash, or fastenings.

1. Set glass in full bed of glazing tape or sealant. Clean glazing material after stops are installed. Clean excess compound, etc. from glass after setting in conformance with glass manufacturer's recommendations.
2. If recommended prime surfaces prior to glazing.

H. Set glass with reams (waves) running horizontally. Set glass with factory attached labels in place.

I. Setting Blocks: Place setting blocks at locations recommended by glass manufacturer, generally between 1/4 points and 6 inches from corner, except at glazed doors.

1. At glazed doors, provide one block at sill, located 3 inches up from edge of glass at hinge side; one block at hinge side jamb, located 3 inches up from lower edge of glass; one block at head, located 3 inches from edge of glass at latch side of door; and, one block at jamb at lock side of door, located 3 inches down from edge of glass at top corner.
2. Use blocks of length required to properly support glass. Offset approximately 1 inch from shims.

J. Glass Installation in Steel (Hollow Metal) Frames:

1. Glaze frames using pre-shimmed tape on both sides. Firmly glaze in place with joints sealed, free of rattles.
2. Set glass on setting blocks with a full bed of sealant or glazing tape.

K. Glass Installation in Aluminum Frames:

1. Glaze aluminum frames using preformed EPDM elastomeric glazing extrusion separately or in combination with sealant and pre-shimmed glazing tape in compliance with aluminum frame supplier's recommendations.
2. Set glass on setting blocks as recommended by manufacturer.
3. Apply tape and/or sealant to produce uniform sight line even with frame.
4. Set glass in gaskets with corners sealed.

L. Glazing Sealant: Along entire bottom edge of light, and up at least 6 inches at each jamb, gun in continuous full bed of sealant to fill voids.

1. Fill entire space, full width of pane, full depth of glass, with sufficient sealant to form heel along inside face and edge of glass.
2. At other edges (top and sides) gun in continuous heel bead of sealant along edges of glass perimeter to set stop against and into, acting as fill between glass and stop.
3. Immediately after setting glass, at entire perimeter of glass, gun in sealant between stop and glass so space above spacer is completely filled, without voids.
4. Place sealant flush with daylight edge of stops, with slight watershed at exterior. Provide straight, smooth surface meeting at opening corners with sharp intersection.
5. Leave no sealant on exposed surfaces of stops and glass.

M. Apply structural sealant carefully in uniform thickness pushing bead ahead of nozzle and making sure that entire cavity is filled. Air pockets or voids along edges are not acceptable.
1. Tool joint immediately after application.
2. Tool neatly, forcing sealant into contact with joint sides, eliminating internal voids and insuring good substrate contact.
3. Do not tool with soap or detergent solutions.
4. Install silicone structural butt glazing system in accordance with manufacturer's printed instructions.

3.4 CLEANING

A. Remove surplus materials.

B. Final cleaning of glass by Contractor.

END OF SECTION

SECTION 092913
GYPSUM SHEATHING

Issued, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior gypsum sheathing for walls and roof assemblies.
   2. Sheathing joint and penetration treatment.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory." GA-600, "Fire Resistance Design Manual."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 EXTERIOR GYPSUM SHEATHING

A. (GYP SHTG-2) Glass Face Gypsum Sheathing: High-moisture resistant board with water-resistant silicone or wax treated gypsum core and fiberglass reinforced faces manufactured in accordance with ASTM C1177 specially designed for exterior substrate.
   1. Thickness: 5/8 inch thick, Type X.
   2. Size: Manufacturer's standard
   3. Available Manufacturer:
      a. Georgia-Pacific Gypsum: DensGlass Sheathing.
      b. Certainteed: GlasRoc Sheathing.

c. USG: Securock Glass-Mat Sheathing.
d. National Gypsum Company: eXP Sheathing Fire-Shield.

B. (GYP SHTG-4) Fiberglass Face Gypsum Sheathing (Roof):
1. Thickness: 5/8 inch thick, Type X.
2. Size: Manufacturer's standard
3. Georgia-Pacific: Densdeck
4. USG: Securock
5. National Gypsum Company: DEXcell

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. For wall sheathing, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing, use screws that comply with ASTM C 954.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8 inch setback where non-load-bearing construction abuts structural elements.

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

G. Vertical Installation: Install 48 inch wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

END OF SECTION

SECTION 096623
EPOXY-RESIN TERRAZZO FLOORING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparation of concrete substrate for epoxy thinset flooring.
   2. Epoxy terrazzo flooring (TER-3) and (TER-4), border and base with divider strips.
   3. Curing, grinding and sealing.
   4. Precast epoxy terrazzo stair treads (TER-5).

B. Related Sections:
   1. Section 033000 - Cast-in-Place Concrete: Preparation of concrete slab.

1.2 DESCRIPTION

A. Epoxy Terrazzo (TER-3) and (TER-4): 3/8 inch minimum terrazzo topping bonded to concrete base slab.

B. Precast Epoxy Terrazzo Stair Treads (TER-5): 2 inch thick precast terrazzo stair treads.

1.3 REFERENCES

A. Terrazzo Technical Data, National Terrazzo and Mosaic Association, Inc. (NTMA).

1.4 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300. Indicate divider strip layouts and details of abutting items.

B. Samples: Submit 2 samples of each color or chip mixture variation of terrazzo required for this project.

C. Maintenance Instructions: Submit 2 copies of written instructions for recommended periodic maintenance of each type of terrazzo.

1.5 QUALITY ASSURANCE

A. Epoxy-Resin Terrazzo Flooring shall comply with 2013 CBC 11B-302.1.

B. NTMA Standards: Comply with specified provisions and recommendations of National Terrazzo and Mosaic Association, (NTMA).

C. Installer's Qualifications: Installer of epoxy terrazzo shall be approved by manufacturer of epoxy terrazzo matrix and member of N.T.M.A. (National Terrazzo and Mosaic Association).

D. Source Limitations: Obtain primary terrazzo materials through one source from single manufacturer. Obtain each color, grade, type, and variety of aggregate from one source with resources to provide materials of consistent quality in appearance and physical properties.

E. Mockups: Install mockup of 100 sq ft of typical flooring for each color and pattern, to demonstrate aesthetic effects and qualities of materials, joint conditions and execution. Approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Meeting: Conduct a preinstallation meeting to coordinated joint details and substrate conditions. Schedule this meeting well in advance of installation so submittals can include information resulting from this meeting. Attendees should include trades involved in related construction especially substrate conditions. Publish minutes of this meeting and instruct all workers regarding actions required.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

PART 2 PRODUCTS

2.1 EPOXY TERRAZZO MATCHING MATERIALS

~~A. Type and Manufacturer (TER-3) and (TER-4): Thin-Set Epoxy Terrazzo #1100 decorative flooring system by General Polymers/Sherwin-Williams.~~

~~1. Refer to Material Identification Codes. *ADD-3*~~

A. (TER-3) and (TER-4) Basis of Design Type and Manufacturer: Terroxy Resin Systems Epoxy Matrix by Terrazzo & Marble Supply Companies, Wheeling, IL (www.tmsupply.com)

1. Refer to Material Identification Codes. ***ADD-3***

B. Other Acceptable Manufacturers:

1. Dex-O-Tex/Crossfield Products.
2. Key Resin Company.
3. Terroxy Resin Systems (Basis of Design) ***ADD-3***
4. Hi-Tek Polymers, Inc.
5. Or District approved equal.
6. General Polymers/Sherwin-Williams ***ADD-3***

C. Divider Strips (FDS-1): “T” type, angle type, zinc.

1. Expansion Type: Neoprene filled, 1/8 inch exposed thickness.
2. Strip Adhesive: 100% solids epoxy resin adhesive recommended by manufacturer ***ADD-3***

D. Flexible Reinforcing Membrane:

1. Manufacturer’s recommended epoxy membrane for substrate crack preparation and reflective crack reduction along with fiberglass scrim reinforcement. ***ADD-3***

E. Primer: Moisture vapor mitigation-treatment primer as recommended by manufacturer for intended use. ***ADD-3***

1. Primer Perm Rating: 0.3 perms maximum with 100% RH ***ADD-3***

F. Sealer: Water based acrylic-urethane sealers as recommended by manufacturer.

1. VOC less than 50 g/L.

2.2 PROPORTIONING

A. Topping: Provide chips and variation of chips to match Architect sample.

2.3 PRECAST EPOXY TERRAZZO

A. Precast Epoxy Terrazzo Manufacturers:

1. Precast Terrazzo Enterprises, Inc.
2. Romoco Precast Terrazzo.
3. Wausau Tile Inc.
4. Or District approved equal.

B. Precast Terrazzo Stair Treads (TER-5): Minimum 2-inches thick, epoxy terrazzo stair treads. Comply with manufacturer's written instructions for fabricating precast units in sizes and profiles indicated. Reinforce units as required by stair tread sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to 1/8-inch radius.
   1. Color, Pattern, and Finish: Red (custom mixture TBD by Architect), black epoxy abrasives.

PART 3 EXECUTION

3.1 WORKMANSHIP

A. Install terrazzo after concrete substrate has been cured for 28 days minimum.

B. Install divider strips straight and level to existing pattern.

C. Produce terrazzo finish surface to match existing, with minimum of 70 percent marble chips exposed.

3.2 PREPARATION

A. Examine surfaces which are to receive terrazzo and accessories, and conditions under which terrazzo work is to be performed. Do not proceed with terrazzo work until unsatisfactory conditions have been corrected.

B. Clean concrete slab free from foreign matter.

C. Prior to installing terrazzo, ensure that surfaces are level, with maximum surface variation of 1/8 inch in 8 feet.

D. Mask and provide other protection required to prevent staining or other marks or damage to other materials. Verify dimensions prior to starting work.

E. Prepare surfaces to receive terrazzo as recommended by mortar or adhesive manufacturer. Roughen surfaces which are glossy or which have loose surface material by sanding or scarifying. Remove surface material that is not compatible with adhesive. Use primer when recommended by adhesive manufacturer. Clean thoroughly to remove oil, dirt and dust.

F. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
   1. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
   2. Use flexible reinforcing membrane for isolated cracking in concrete substrate. Route and fill cracks with epoxy primer applying reinforcing membrane with fiberglass scrim across cracks in accordance with manufacturer’s recommendations. ***ADD-3***

G. Moisture Testing:
   1. Test for moisture by anhydrous calcium chloride method according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   2. Test for moisture by relative humidity probe and digital meter method according to ASTM F 2170. Proceed with installation only after substrates have a maximum relative-humidity-measurement reading of 70 to 75 percent in 24 hours.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."

C. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

D. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

E. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

F. Divider and Control-Joint Strips:
   1. Locate divider strips in locations indicated. Spacing of divider strips should be 12 ft. maximum.
   2. Install control-joint strips back to back directly above concrete-slab control joints in locations indicated.
   3. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

3.4 FLOORS

A. Thinset Terrazzo: ~~1/4 inch to~~ 3/8 inch minimum terrazzo topping bonded to concrete base slab. ***ADD-3***

3.5 BASE AND BORDER

A. Vertical Base: ~~1/4 inch or~~ 3/8 inch minimum topping on underbed bonded to wall. ***ADD-3***

B. Border: Form border with division strip.

3.6 FINISH

A. Finish terrazzo to NTMA standards and as selected by Architect.

B. Grind terrazzo surfaces with power disc machine, sequence with course and fine grit, wet method.

C. Apply grout mix (to match mortar) over ground surface to fill honeycomb exposed during grinding.

D. Remove grouting coat by grinding using fine grit abrasive.

E. Hand grind base and cove similarly.

F. Dust shall not be permitted to coat surfaces. Remove grinding mud from site immediately. Finish terrazzo to eliminate grinding dust and to protect other building features.

G. Scrub and clean surfaces immediately following last grinding, rinse and neutralize. Apply minimum of 2 coats of sealer to terrazzo surfaces per manufacturers written instructions.

3.7 PRECAST TERRAZZO INSTALLATION

A. Install precast terrazzo stair treads using method recommended in writing by NTMA and manufacturer unless otherwise indicated.

B. Do not install units that are chipped, cracked, discolored, or improperly finished.

3.8 CLEANING AND PROTECTION

A. Protect terrazzo from damage and stains during construction. Place suitable non-staining coverings over terrazzo and keep in place until final cleaning.

B. Near end of project, re-scrub, clean, and resurface damaged areas if necessary. Terrazzo shall be undamaged, clean and in like-new condition.

END OF SECTION

SECTION 102226.10
VERTICAL FOLDING WALL SYSTEM

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Work Included:
   1. Automatic vertical folding acoustical wall system (VWS-1), necessary hardware, seals, lifting machinery, and electrical controls.

B. Related Sections:
   1. Electrical: Site wiring and connections for main power, including disconnect switches at each motor location. Site wiring and connections for control, including installation of key switches.

1.2 SYSTEM DESCRIPTION

A. Automatic vertically folding acoustical operable wall shall be acoustical partitions that, when in down position (closed) are hard, rigid, flat, plumb walls, made of a grid of rectangular acoustical panels, and when are lifted (opened), fold upward (vertically) without use of any manual labor into pocket in ceiling. In the down (closed) position, wall shall be comprised of 2 vertical plans of acoustical panels, separated by acoustical air space.

B. Operable wall shall open and close in manner that all wall panels fold and unfold at exact same time, at exact same rate.

C. Drive System: Motor/shaft/drum assembly shall be offset from centerline of operable wall.

1.3 PERFORMANCE

A. Operable wall shall be opened and closed using spring return, three-position key switch. Turning key from “off” position shall cause wall to move in designated direction “up” or “down.” When hand pressure is removed, wall shall stop immediately. Operable wall shall stop in quick and positive fashion without coasting. As normal part of operation, it shall be possible to partially open (or close) wall, stop it and then reverse operation. There shall be two key switches per operable wall, on either side of axis of wall.

B. From fully open position, wall shall be able to go through its entire cycle of closing and/or opening without any manual intervention.

C. When operable wall is being lowered (closed), it shall come automatically to rest once it has reached fully down (closed) position.

D. When operable wall is being lifted (opened), it shall come automatically to rest once it has reached fully up (open) position.

E. Operable wall shall automatically and acoustically seal against floor without need for any manual intervention. Floor seals shall leave joint between floor and bottom acoustical panels of not more than 1-1/2 inch.

F. Operable wall shall automatically and acoustically seal against two end walls without need of any manual intervention. End seals shall act in such a way as not to come into contact with end walls while operable wall is in motion. End seals shall leave a joint between acoustical panels and end walls of no more than approximately one inch. Once wall reaches down position, end seals shall activate automatically. Key switch shall be held for duration of operation.

G. Operable wall shall automatically and acoustically seal against ceiling without any manual intervention. Top seals shall leave joint between top acoustical panels and ceiling of pocket of not more than 1-1/2 inch.

H. Operable wall shall open and close at constant nominal speed of 5 to 10 vertical feet per minute.

I. When operable wall is being lowered (closed), it shall stop if leading (bottom) edge comes into firm contact with any object between it and floor. Regular operation of wall shall resume once key switch has been released and direction of the wall has been reversed and obstruction removed.

J. Operable wall shall be visibly flat and rigid in down (closed) position.

K. There shall be no exposed hinges, brackets, screws, and no part of mechanical system shall be visible when operable wall is in down (closed) position.

L. Panel edges shall be right angled, with minimum radius not more than 1/16 inch.

M. Panels shall be rectangular, nominally of same size.

N. Joints between panels, vertical and horizontal, shall be no more than ½ inch wide.

O. Each acoustical panel shall be individually removable using only a screw driver. No special tools or equipment shall be required. Removal of single acoustical panel shall not affect, dislocate or cause removal of any adjacent panels or other acoustical panels.

P. Operable wall shall be mechanically operable with few of acoustical panels removed from one, or both, sides of operable wall.

Q. Operable wall shall not weigh more than 8 lbs. per square foot, not including the lifting equipment and architectural finish or other acoustical panels.

R. Completely functioning operable wall, tested in accordance and compliance with ASTM E90 shall achieve Laboratory Sound Transmission Class (STC) rating of not less than 50. Acoustical panels, when tested in accordance with the ASTM E90 protocol, shall achieve Laboratory Sound Transmission Class (STC) rating of not less than 54.

S. Operable wall shall be designed to have design life of at least 10,000 complete closed to opened to closed cycles.

1.4 QUALITY ASSURANCE

A. Work and materials specified herein shall be installed only by qualified installer of manufacturer, according to manufacturer's written instructions.

1.5 SUBMITTALS

A. Submit manufacturer's technical data for each type of operable wall specified herein.

B. Submit shop drawings showing complete layout of operable wall system based on field verified dimensions. Drawings shall include dimensional relationships to adjoining work. Include details indicating materials, finishes, tolerances, methods of attachment and electrical requirements.

C. Submit a 12 1nch by 12 inch sample of wall panel with specified finish.

D. Submit certified test reports evidencing compliance to acoustical STC requirements as specified.

1.6 SITE CONDITIONS

A. Floor underneath operable wall along its axis shall be flat to within ±1/4 inch over entire length of operable wall. Peak to valley undulation of ±1/4 inch shall not be closer together than 24 inch, and peak to valley undulation of ±1/8 inch shall not be closer than 12 inches.

B. Support steel above operable wall along its axis shall be parallel to floor within ±1/2 inch for entire length of operable wall. This includes loaded deflection. Beam shall also be paralleled to centerline of wall within ±1/8 inch left to right.

C. Fixed walls at either end of operable wall shall be within ±1/4 inch -0 from plumb vertical.

D. Fixed walls at either end of operable wall shall be flat to within +0, -1/4".

1.7 WARRANTY

A. Operable wall shall be warranted free of defective materials and workmanship for a period of two years or 5,000 cycles, from date of shipment, whichever occurs first.

B. Parts and labor required to maintain operable wall and part subject to normal wear and tear are not covered under the warranty and are Owner's responsibility.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design Product/Manufacturer: Vertically Folding Walls (VWS-1), Basis of Design: Skyfold Classic 51 SKY-19125A as manufactured by Railtech Composites, Inc., Plattsburgh, New York (phone 514/457-4767), ~~or District approved equal~~. ***ADD-3***

B. Other Accepted Manufacturers: ***ADD-3***

1. District approved equal

2.2 ACOUSTICAL MATERIALS

A. Acoustical panels shall be faced with steel that is compatible with fabric coverings.

B. Acoustical panels and sound insulation shall be made of non-combustible fire-treated materials.

C. Acoustical panels shall be fabricated to satisfy rigid criteria when operable wall is down (closed) and to ensure that there is no interface between panels when wall is in motion.

D. Acoustical panels shall be flat with no bowing, oil canning, warping, waviness or other surface deformation and discontinuity.

E. Acoustical panels shall have fabric finish: Refer to Material Identification Codes.

2.3 FOLDING MECHANISM

A. Hanging, folding and extension mechanism shall be made from structural grade aluminum extrusions and structural shapes.

B. Wear surfaces, such as bushings, spacers, pins, discs, bearings, sleeves shall be designed to function quietly and with minimum wear, over the 10,000 cycle design life of operable wall.

C. Hangers, which fasten lifting mechanism to support steel, shall be fabricated from stele and shall be welded or bolted to support steel.

2.4 LIFTING EQUIPMENT

A. Lifting equipment shall be sized so that it can open and close wall effectively over the 10,000 cycle design life of wall, at minimum design speed.

B. Lifting mechanism shall be designed to function smoothly, quietly and safely. Ball bearings shall be used instead of bushings.

C. Provide wire rope cable for every set of lifting mechanisms. This cable shall be of 6 x 31 construction aircraft cable and shall be made of galvanized steel or stainless steel. Diameter of cables shall be sized so that they are able to hold entire weight of wall with safety factor.

D. For the standard drive system, each wire rope cable shall wind and unwind on its own cable drum. Cable drums shall be grooved to acceptable single layer of cable and shall have a minimum pitch diameter of 20 times cable diameter. Length of drums shall be sufficient to accommodate 3 cable safety wraps. Cable drums shall be keyed to line shaft.

E. Line shaft, sized to deliver required torque with minimum deflection, shall support and rotate cable drums.

F. Pillow block bearings (for standard drive system), of appropriate size, shall support line shaft and be located immediately on either side of each cable drum.

G. For the standard drive system, line shaft shall be connected directly to power drive through properly sized, load rated couplings, keyed to line shaft.

H. Power drive shall be sized to deliver sufficient amount of torque to safely and effectively raise and lower the operable wall over its design life.

I. Lifting equipment shall use latest industry standards in thermal protection, overload protection, and quick acting fuses in order to ensure safety and reliability of system.

2.5 SAFETY EQUIPMENT

A. Operable wall shall employ an electromagnetic type of brake which shall activate firmly, without hesitation, when power is lost to system. This brake shall have minimum regarding torque rating equal to 200% of the power drive full load torque. Manual break release lever shall be supplied on motor.

B. Operable wall shall employ dynamic brake, distinct and separate from brake in paragraph 2.5.A in order to lower wall at controlled speed of no more than approximately 150% of the normal down speed in case of catastrophic failure in power train. Alternately, operable wall shall employ brake, distinct and separate from brake in paragraph 2.5.A in order to completely halt downward motion of wall in case of catastrophic failure in power train.

C. Operable wall shall employ electrical or other limit switches in order to stop wall at its up and down travel limits.

D. Operable wall shall employ over torque detector in order to sense jamb in system and to act as over travel limit in up direction should primary limit switch fail to act. This over torque sensor shall be mechanical, using motor's torque arm in its over torque detection.

E. Entire length of bottom edge of operable wall shall be equipped with a continuous pressure sensing strip which shall cut power to lifting equipment and shall activate brake outlined in paragraph 2.5.A, if sensing edge comes in firm contact with object before wall is in full down (closed) position. Power shall remain cut to lifting equipment until key switch has been released or direction of wall has been reversed and obstruction is removed.

2.6 FABRICATION

A. Factory assemble components, assemblies and systems into largest possible assemblies in order to minimize amount of assembly on site.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect relevant aspects of site such as evenness of floor, walls and structural steel, and ensure that these are within tolerances stated in Part 1 of this specification.

B. Confirm any deviations from these tolerances. Do not proceed until these conditions are corrected.

C. Carry out appropriate field measurements before manufacturing any components or assemblies.

3.2 INSTALLATION

A. Install operable walls in accordance with reviewed shop drawings and manufacturer's printed instructions.

3.3 ADJUSTING AND CLEANING

A. Adjust and fine tune operable walls to ensure that seals are operating and sealing properly and that walls are in correct and smooth operation.

B. Clean up any dirt, oil or grime that may have found its way onto acoustical panels. Leave wall in state of architectural cleanliness.

3.4 SPARE PARTS

A. Ensure that the correct number of spare parts that were requested are safety stored in secure areas designated by the Architect or Owner.

END OF SECTION

SECTION 102813
TOILET ACCESSORIES

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Toilet and bath accessories.
   2. Building accessories
   3. Warm-air dryers.

B. Related Sections:
   1. Section 092900 - Gypsum Board: Metal anchor reinforcement in walls.
   2. Section 093000 - Tiling: Ceramic tile bath and shower accessories.

1.2 SUBMITTALS

A. Submit in accordance with Section 013300

B. Product Data: Illustrate each accessory at large scale and show installation method.

C. Samples: Submit finish samples.

D. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.

E. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.

F. Maintenance instructions, including replaceable parts and service recommendations.

1.3 QUALITY ASSURANCE

A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
   1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
   2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.4 DELIVERY, STORAGE AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in manner to protect accessory and its finish.

1.5 PROTECTION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this section.

1.6 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:

B. Washroom Equipment

1. Bobrick Washroom Equipment Inc. (Basis of Design)
2. American Specialties Inc.
3. Bradley Corporation
4. GAMCO
5. Or District approved equal.

C. Warm-Air Dryers:

1. Bobrick Washroom Equipment, Inc. (Basis of Design)
2. Excel Dryer Corporation.
3. World Dryer.
4. Or District approved equal.

D. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated. Adhesive: Epoxy type contact cement.

B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

D. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication

F. Fasteners, Screws, and Bolts: Hot dip galvanized. Expansion Shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate. Provide exposed fasteners with finish to match accessories.

2.3 FINISHES

A. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

B. Chrome/Nickel Plating: Satin finish.

C. Stainless Steel: No. 4 satin finish.

D. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

2.4 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

E. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

F. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

G. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 PREPARATION

A. Deliver inserts and rough-in frames to jobsite at appropriate time for building-in. Provide templates and rough-in measurements as required.

B. Before starting work notify Architect in writing of conflicts detrimental to installation or operation of units.

C. Verify exact location of accessories with Architect. Verify blocking is in place prior to gypsum board installation.

D. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

3.2 INSTALLATION

A. Install fixtures, accessories and items in accordance with manufacturer's printed instructions.

B. Install true, plumb and level, securely and rigidly anchored to substrate and sealed to protect structural elements of wall from moisture.

C. Use tamper proof (security) type fasteners.

3.3 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's recommendations after removing labels and protective coatings.

3.4 TOILET AND BATH ACCESSORY SCHEDULE

A. Building Accessories:
   1. (BA-2) Mop and Broom Holder with Shelf: Bobrick B-239 X 34 with shelf, 4 hooks and 3 mop/broom holders 34 inches long, or District approved equal.

B. Coat Hooks:
   1. (CH-1) Robe Hooks: Bobrick B-76717, satin finish, 1-5/8 inch projection, single hook, or District approved equal.
   2. (CH-2) Robe Hooks: Bobrick B-76727, satin finish, 1-7/8 inch projection, double hook, or District approved equal.

C. Grab Bars:
   1. (GB) Grab Bars: Bobrick Series 6806, 1-1/2 inch diameter with concealed mounting, with 1/8 inch thick stainless steel plate.
      a. Sizes and configurations as indicated.
      b. Use Bobrick Series 6806.99, for grab bars in showers or steam rooms.
      c. Or District approved equal.

D. Hand (Hair) Dryers – Electric:
   1. (HD-1) Electric Hand Dryers: Bobrick B-3725, recessed with 2" projection from wall, electric with automatic operation, stainless steel, 1000 watts, or District approved equal.

E. Mirrors:
   1. (MIR-1) Framed Mirrors: Bobrick B-290 Series, sizes as indicated, with Johnson Defender Film applied, or District approved equal.

F. Paper Towel Cabinets:
   1. (PTC-1) Combined Paper Towel Dispenser and Waste Receptacle: Bobrick B-3974, recessed compact unit, 12 gallon capacity, automatic, or District approved equal.
   2. (PTC-2) Paper Towel Dispensers: Bobrick B-29744, semi-recessed, automatic, roll paper towel dispenser, or District approved equal.

G. Soap Dispensers:
   1. (SDISP-1) Automatic Soap Dispensers: Bobrick B-2013, foam soap dispenser with "AA" batteries, sensor activated, surface mounted, or District approved equal.

H. Sanitary Napkin Cabinets:
   1. (SNC-1) Sanitary Napkin/Tampon Dispensers: Bobrick 37063, 25 cent operation, recessed mounted.

I. Sanitary Napkin Disposal Units:
   1. (SND-1) Sanitary Napkin Disposal Units: Bobrick B-279 ~~254~~, surface mounted. ***ADD-2***

J. Toilet Paper Holders:
   1. (TPH-4) Toilet Paper Holders: Bobrick B-2892, twin jumbo-roll toilet tissue dispenser, surface mounted. Or District approved equal.

K. Toilet Seat Covers:
   ~~1. (TSC-2) Toilet Seat Covers: Bobrick 221, surface mounted, or District approved equal.~~
   1. (TSC-1) Toilet Seat Covers: Bobrick 221, surface mounted, or District approved equal. ***ADD-3***

L. Utility Shelves:
   1. (US-3) Stainless Steel Shelf with Mop/Broom Holders and Rag Hooks: Bobrick B-239, 8 inch deep, surface mounted, or District approved equal.

M. Waste Receptacles:
   1. (WRC-1) Waste Receptacles: Bobrick B-2280, free standing, 13 gal open top, or District approved equal.
   2. (WRC-3) Waste Receptacles: Bobrick B-279, waste receptacle, surface mounted, or District approved equal.

END OF SECTION

SECTION 105626.13
MANUAL MOBILE STORAGE SHELVING

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pre-engineered, prefinished high density mobile storage system, consisting of moveable and stationary units, complete with tracks, full raised floor, ramp, operation handles, end panels and shelving system, with supports, standards, and accessories.
   2. Bolt setting grout.
   3. Manufacturer's 2 year warranty.

1.2 QUALITY ASSURANCE

A. Approved Installer: Installation of storage systems and accessories shall be by manufacturer's approved installer specializing in storage system installation with not less than 3 years of experience in installation of systems similar to that required for this project.

B. Manufacturer's Qualifications: Firm (material producer) with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

1.3 DESIGN

A. Design: Performed in accordance with applicable codes and standards to safely support design loads without excessive deflections or stress.

B. Design Calculations: Performed and certified by Professional Structural Engineer registered in the State where project is located, experienced in steel design. These certified calculations shall be submitted to the Architect upon request. Calculations shall include storage system members and connections, and connections made from storage system to main structure.

C. Design Loads: Design of storage systems shall consider following loading parameters as well as applicable code loads:
   1. Uniform live load of 125 psf.
   2. Storage system dead loads. Loaded weight of Cine System: 11,936#.
   3. Concentrated live load of 1500#, placed on space 2-1/2 feet square, wherever this load placed upon otherwise unloaded floor would produce stresses greater than those caused by design uniform loads.

D. Deflections: Deflection design limits of storage system shall be as follows:
   1. Maximum shelving deflection under full loads shall not exceed 1/4 inch.
   2. Maximum floor system component deflection shall not exceed 1/240 of component span.
   3. Building Movement: Provide for one inch movement of foundation wall after installation of storage system.
   4. Obstructions: Design of supporting structure in the main and secondary aisles shall be such that any obstructions are minimal and do not inhibit pedestrian or cart traffic.

1.4 SUBMITTALS

A. Shop Drawings: Submit fabrication and installation drawings in accordance with Section 013300. Shop drawings shall be certified by Professional Engineer Registered in State where project is located, experienced in steel design.
   1. State storage system component manufacturer's name, sizes, types, quantities, locations, painting and accessories included.

B. Show connections required and include details and instructions as necessary for complete assembly and installation of storage system including assembly attachments to structure.

C. Samples: Submit samples for color and finish selection. Submit samples of laminate face panels for color selection and appearance acceptance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Package, deliver, handle, store, install and erect at job site to avoid damage.

B. Deliver in timely manner for installation in proper sequence with work of other trades.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Type and Manufacturer: Quik-Lok™ four-post shelving manufactured by Aurora Storage Products, Inc.

B. Other Acceptable Manufacturers: Spacesaver Corporation, Magic Aisle #810 by Acme Visible Records, TAB Storage Systems Modular Mobile, or District approved equal.

2.2 MATERIALS

A. Sheet Steel: ASTM A446; stretcher leveled, prime grade furniture steel; 1.25 oz/sq ft galvanized coating (A366; stretcher or roller levelled prime grade furniture steel; E finish).

B. Steel Shapes: ASTM A36; galvanized.

C. Steel Rails: Minimum 1035 case hardened steel, one-piece.

D. Grout: Hydraulic type polymer cement.

E. Plywood: 3/4 inch, 5 ply, B-D exterior grade.

F. Plastic Laminate; NEMA LD3; 0.050 inch thick by Wilsonart; color as selected.

1. Laminate Backing Sheet: NEMA LD3; BK20 backing grade, undecorated plastic laminate.

2.3 GENERAL DESIGN

A. Storage System Requirements: Maximum overall height of system shall be 90 inches. Construct stationary units of same materials as moveable units so that shelving heights are consistent throughout system. Overhead raceway assemblies, anti-tips and other components mounted on top of shelving shall not project beyond 90 inch ceiling height.

B. Cine System shall cover overall area as indicated on drawings.

C. Manual operation shall provide for efficient movement of one or more ranges. Physical effort to start unit moving (each fully loaded 1600 lbs) moveable carriage shall not exceed 5 pounds.

D. System alignment: 1/2 inches maximum variation, measured between edges of end panels within each range in aisle positions.

E. Components shall exhibit no abnormal friction, abrasion, binding, or wear on or between contact surfaces and drifting or rolling of stopped carriages will not be acceptable.

2.4 FABRICATION

A. Rails: One-piece steel rail, 2-1/2 inches wide, 1-1/8 inches high, formed into tee section with wide base flange for lateral support and ability to anchor rails to subfloor.

B. Provide tongue and groove interlocking design rail connection joints to provide horizontal and vertical continuity between rail sections and to gradually transfer concentrated wheel point load to and from adjoining rail sections. Do not butt splice rail joints.

C. Level and grout rails locate and position properly, work grout under rail completely filling voids and trim up sides flush with rails.

1. Rail Levelness: 3/32 inch maximum variation from true level within module; 1/16 inch maximum variation between adjacent rails, perpendicular to rail direction; 1/32 inch maximum variation in 10 feet of rail length, along rail in system.

D. Recheck rails for integrity of position and levelness and anchor into original concrete using minimum one inch rawl plugs and 2 inch by #10 screws not to exceed 4 foot on center.

E. Grout: Hydraulic type polymer cement compound which, when mixed with water, will harden rapidly to produce permanent bolt setting anchor.
   1. Compound: Based on performance of test specimens at room temperature and in laboratory air. to following:
      a. Linear Movement: Exhibit slight expansion of not more than 0.002 inch per lineal inch on setting, it shall not shrink.
      b. Compression Strength: ASTM Standards tested on Balding-South-ward machine of 60,000 lbs. capacity - 2 inch cubes shall have following average compression strengths:
      c. Age: One hour -- 4,500 psi 28 hours -- 5,000 psi 7 days -- 8,000 psi.
   2. Content: Compound shall contain no Portland cement, ferrous metals or rust promoting agents.

F. Raised Floor and Ramp: Incorporate manufactured raised floor system between adjacent rails and at back of system at bays of moveable system. Finished elevation of raised floor: Flush with top of rails.

G. Provide continuous ramp at front of system not to extend past front of the carriages and having maximum slope of 9 degrees. Vertical transition from ramp edge to base floor shall be maximum of 1/8 inch.
   1. Construct raised floor panels of minimum 3/4 inch thick plywood as specified. Raised floor and ramp assembly shall support 400 pound concentrated load with maximum deflection of 3/8 inch, or as required to support fully loaded system.

H. Install leveling screws at raised floor and ramp on maximum 16 inch centers to level and support the floor. Anchor floor panels and ramp to base floor to prevent movement.

2.5 CARRIAGES

A. Unit welded construction capable of supporting minimum load of 1, 000 pounds per carriage foot without distortion.Carriage splices, where necessary, shall be tongue and groove tension bolted design to maintain proper alignment.

B. Construct carriage to provide 5/8 inch high shelf retaining flange on top of carriage full length of range to keep shelf storage units centered and aligned. Secure shelving unit upright to carriage frame with vibration proof fasteners of no less than size #12.

C. Load Wheels: Constructed of solid, case hardened steel, minimum 2-3/4 inches in diameter, precision ground and balanced.
   1. Bearings: Permanently sealed, lubricated and self-aligning of ball or roller design.

D. Provide minimum one inch neoprene bumpers between aisles for safety finger space and positive stop for moveable carriages.

E. Finish exposed carriage faces in smooth appearance without exposed holes or protruding bolts.

F. Provide in-rail (carriage mounted) or overhead (top shelf mounted) anti tip assembly per moveable carriage. Anchor entire system to stationary platforms and wall.

G. Finish paint carriages same color as shelving as selected by Architect.

2.6 FACE PANELS

A. Exposed Ends: High pressure plastic laminate, provide backer sheets as specified to prevent panel warping. Panel edges of plastic T-mold edging. Color or pattern as selected by Architect.

2.7 SHELVING EQUIPMENT

A. Design: 4-post, wedge locking design consisting of 3 basic parts, uprights, shelves, and shelf supports, assembled without nuts, bolts, studs, sway braces, gussets or clips. Punch shelves to accept center stops.

1. Front and back flange of shelf shall be flush with outside face of post. Shelves shall be adjustable on 1-1/2 inch vertical centers.

B. Top and bottom closure shelves shall be solid sheet metal. Provide intermediate storage shelves of ~~wire~~ solid sheet metal design capable of supporting ~~cine film cans~~ (50 pound capacity per shelf) ~~or shelves appropriate for pharmaceutical materials where indicated~~. ***ADD-2, ADD-3***

C. 6 foot range lengths consist of two 36 inch wide shelving sections. 8 foot range lengths consist of two 30 inch wide and one 36 inch wide shelving sections. Solid sheet metal shelving, dimensions as indicated in Drawings***. ADD-3***

D. ~~Vertical shelf openings minimum 6 inches on center for 12 inch deep shelving and 9 inch on center for 8 inch deep shelving. 12 inch deep shelving sections shall be 12 usable wire solid sheet metal shelves high plus solid canopy top dust covers and bottom shelves. 8 inch deep shelving sections~~ shall be 8 usable ~~wire~~ solid sheet metal shelves high plus solid canopy top dust covers and solid ~~bottom shelves~~ sheet metal shelf openings per Drawings. ***ADD-2, ADD-3***

E. Shelving components shall exhibit no dents, oil-canning, buckling, or other surface irregularities.

1. Steel gauges:
   a. Upright frames: 18 gauge.
   b. Shelf supports 36 inch (file): 14 gauge.
   c. Top and bottom shelves: 22 gauge.

F. Shelving finish abrasion resistance: ASTM D968, 25 liters per mil.

G. Shelving Components: Provide components free of burrs, sharp edges, projecting hardware and other defects which could present hazards to materials or personnel.

2.8 FINISH

A. Factory Finish: Solid ~~and wire~~ shelves and shelving system shall be finished with electrostatically applied powder coating system using epoxy-polyester hybrid powder paint in color as selected by Architect from manufacturer's standard colors. Apply to 1-1/2 mil thickness. ***ADD-2***

PART 3 EXECUTION

3.1 INSTALLATION

A. Install storage system in accordance with reviewed shop drawings and manufacturer's instructions.

B. Coordinate with other trades involved where required for installation.

C. Install storage shelving system and accessories plumb and true, and securely anchor in-place.

END OF SECTION

SECTION 115310
LABORATORY CASEWORK AND OTHER FURNISHINGS

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wood Laboratory Casework and Tables
B. Metal Laboratory Casework and Tables
C. Cabinet Hardware
D. Zoology and Ornithology Specimen Cabinets
E. Map Storage File
F. Laboratory Work Surfaces
G. Downdraft Dissection Table with Hinged Cover
H. Shelving Assemblies
I. Cylinder Restraint Assembly
J. Overhead Service Carriers
K. Overhead Support Grid (Overhead Unistrut)
L. Pipe Drop Enclosure
M. Drying Rack
N. Accessories
O. Finish for Miscellaneous Wood Items
P. Metal Fabrications
Q. Stainless Steel Fabrications
    1. Work Surfaces
    2. Laboratory Sinks
    3. Scullery Sinks
    4. Canopy Hoods
R. Slotted Channel Framing (Strut)
S. Sealant

1.2 RELATED SECTIONS

A. Division 09 – Flooring (wall base)
B. Section 115313 – Fume Hoods and Other Air Containment Units
C. Section 115343 – Laboratory Service Fittings and Fixtures
D. Division 22 – Plumbing
E. Division 23 – Heating, Ventilated, and Air-Conditioning
F. Division 26 – Electrical
G. Division 27 – Communications
H. Section 012300 – Alternates ***ADD-2***

1.3 REFERENCES

A. Architectural Woodwork Institute (AWI), Woodwork Institute (WI), and Architectural Woodwork Manufacturers Association of Canada (AWMAC): Architectural Woodwork Standards (AWS), Edition 1, October 2009.

B. Builders Hardware Manufacturers Association: ANSI/BHMA A156.18-2006 American National Standard for Materials and Finishes, 2006.

C. California Code of Regulations: Title 17, Section 93120: Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.

D. Hardwood Plywood & Veneer Association: ANSI/HPVA HP-1-2004 Standard for Hardwood and Decorative Plywood, 2004.

E. National Hardwood Lumber Association: NHLA Rules for the Measurement & Inspection of Hardwood & Cypress, 2007.

F. Scientific Equipment and Furniture Association: SEFA 2-2010 SEFA Recommended Practices for the Installation of Scientific Laboratory Furniture and Equipment.

G. Scientific Equipment and Furniture Association: SEFA 3-2010 SEFA Recommended Practices for Work Surfaces.

H. Scientific Equipment and Furniture Association: SEFA 8-W-2010 Recommended Practices for Laboratory Grade Wood Casework.

I. Scientific Equipment and Furniture Association: SEFA 8-M-2010 Recommended Practices for Laboratory Grade Metal Casework.

J. Underwriters Laboratory: UL61010A-1 Electrical Equipment for Laboratory Use.

K. United States Green Building Council: USGBC, LEED Reference Guide for Green Building Design and Construction For the Design, Construction, and Major Renovations of Commercial and Institutional Buildings Including Core & Shell and K-12 School Projects 2009 Edition.

1.4 BID SUBMITTALS

A. Certification of Compliance: All bidders (including those listed in 2.01-A) must submit a signed compliance certification statement on company letterhead indicating that their bid includes products and installation which comply with every requirement of the project specifications and drawings (accounting for any RFI responses received during the bidding phase). ***ADD-3***

B. Certification of Qualifications: All bidders must submit a signed certification statement of compliance on company letterhead with the Qualifications requirements outlined below. List specific project experience as evidence of compliance. ***ADD-3***

C. Substitution Requests: All substitution requests for this scope of work in this section must be made during the bidding phase. No substitution requests will be considered post-bid.

1.5 SUBMITTALS

A. Refer to General Conditions and Division 1 “Submittal Procedures” for submittal requirements. In addition to these requirements, provide submittal requirements specified herein.

B. Submittal requirements:

1. Submittal shall be prepared individually for this specification section. Arrange product data, drawings and information for submission in a complete set for this specification section.
   a. Shop drawings and product data as applicable for required mockups may be submitted separately and should be expedited for submittal as soon as the contract is awarded.
2. Submittal shall contain complete data for all items of this specification section. Periodic or partial submittals of individual components within this specification section will be returned as incomplete and rejected.
3. Submittals shall be organized by specification sequence with section and paragraph number identified.

4. Equipment and components being proposed shall be clearly labeled with all options and accessories indicated and shall be for this specific project. All non-applicable items shall be deleted or struck.
5. Product data submittals provided in PDF format shall consist of fully collated PDF files allowing for collated printing from a single file.
6. Shop drawings shall meet the requirements of the Architectural Woorworking Standards (AWS), except in cases where stricter requirements are identified in this section.

C. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for work in this section.
   1. Product data shall not be duplicative or redundant with shop drawings. Do not include drawings in the product data submittal that are included in the shop drawings.

D. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules.
   1. Show relationship to adjoining materials and construction.
   2. Show seaming pattern layout of all joints in work surfaces.
   3. Shop Drawings shall be in the form of reproducible, PDF files, or photocopies, to scale, sheet size not to exceed 11 inches x 17 inches (A3).
   4. Shop drawing submittals provided in PDF format shall consist of fully collated files allowing for collated printing from a single file. Blueline prints are not acceptable.

E. Approved Substitution/Approved Equal: In addition to the items required in Division 1, all substitution requests shall include item-by-item comparison of the proposed substitution to this project specification. A copy of the project specification shall be submitted, with each item and subsection of the project specification marked as “Comply” or “Not Comply.” In any cases where “Not Comply” is indicated, an explanation of the relative advantages of the proposed design shall be provided.

F. LEED Submissions: Provide documentation and certification as required relative to the work of this section to support the project’s submission to the USGBC for the credits indicated below.

G. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the Uniform Building Code Earthquake Regulations and the California Administrative Code, Title 24 Seismic Restraint requirements.

H. Samples: Accompanying Materials List, submit for Architect's approval two (2) samples of each type of specified finish and color range available for casework, laboratory work surfaces, painted steel fabrications, cabinet hardware, and shelving.

I. Certifications/ Test Data: Submit certifications and test data as required elsewhere in this section, including SEFA structural performance test reports, and finish performance test reports.

J. Operations/Maintenance Manuals: At project close-out, submit for Architect's review and Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and closest factory representative for components and service.

K. Warranty: Submit manufacturer’s warranty including any additional certifications as needed to meet the requirements specified.

1.6 MOCKUP

A. Provide and install products within this scope of work as part of the laboratory mockup, as indicated on the drawings.

B. Location of mockup must be approved by the Architect and the Owner from the following options:
   1. In final location as shown on drawings. Note that products installed may require correction and/or replacement relative to issues of non-compliance with the contract documents.
   2. In off-site location in the vicinity of the project, provided by the Owner.
   3. At location provided by the laboratory subcontractor, such as the factory.

C. Disposition of mockup:
   1. Mockup items may be incorporated into the final project subject to approval and/or corrections as identified in the mockup review.

2. Mockup items will remain the property of the laboratory subcontractor.

D. The mockup will be reviewed and appropriate comments documented. The mockup – and the associated comments - will become a quality sample against which the remainder of the product installation will be compared.

E. Coordinate delivery, installation, and review of the mockup with the contractor. The mockup should be complete and reviewed prior to fabrication of the remainder of the project. To the extent that the subcontractor elects to fabricate the project prior to review and approval of the mockup, it is understood that this is “at risk” and items may require re-fabrication to address issues that arise from the mockup review.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades.

B. Replacement: Any damaged work shall be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to the Owner.

1.8 ENVIRONMENTAL CONDITIONS

A. It is the responsibility of the general contractor or construction manager to provide appropriate environmental conditions within the laboratory spaces throughout the period of installation of wood and composite wood casework products until substantial completion of the project and turnover to the owner. The relative humidity standards as delineated by the Architectural Woodwork Standards should be followed.

1. Humidity must be controlled between 25% and 55% in all areas where laboratory casework is stored and/or installed.
2. The range of relative humidity change should not exceed 30 percentage points.

B. It is the responsibility of the laboratory furniture subcontractor to assess building environmental conditions prior to the delivery and installation of laboratory casework. Wood laboratory casework shall not, under any circumstances, be installed in spaces which do not comply with the requirements outlined above.

1.9 QUALIFICATIONS

A. Work in this section shall be manufactured by and installed by a company/companies having a minimum of eight years documented experience providing and installing products similar to those specified in laboratory applications; an established organization; and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of products specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified work of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

1.10 ENVIRONMENTAL COMPLIANCE

A. Composite Wood Products – Composite wood products shall comply with the California Code of Regulations: Title 17, Section 93120: Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.

1. The definition of composite wood products, as applied to this requirement, shall be those as defined in the regulation cited.
2. Comply with the limitations scheduled for enforcement at the time of sale and manufacturing, accounting for the grace periods allowed by the regulation.
3. Provide documentation, certification, and labelling as required by the regulation.

B. Certified Wood: All wood products used in the fabrication shall comply with the FSC’s (Forest Stewardship Council’s) Principles and Criteria as required to contribute towards USGBC LEED Credit MR7.

1. All lumber shall come from forestry sources that are certified under the Forestry Stewardship Council's (FSC) Forest Management Certification program.
2. The casework manufacturer must have FSC Chain-of-Custody (COC) Certification.
3. Documentation:
    a. Provide manufacturer's Chain of Custody Certification.
    b. Provide documentation of the cost, volume, and weight of all wood products provided for this project, including any non-FSC wood products or components.
    c. Provide documentation of the cost, volume, and weight of FSC wood products provided for this project.
    d. In the case of assemblies where some components are FSC-certified and other components are not – provide separate cost, volume, and weight information for each assembly component.

C. Low-Emitting Materials – Composite Wood and Agrifiber Products: Composite wood and agrifiber products used in casework products shall contain no added urea-formaldehyde resins, as required to meet USGBC LEED Credit EQ4.4.
    1. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
    2. Provide certification as required.

D. Wood products as listed below shall contain recycled content to contribute towards achievement of the USGBC LEED Green Building Rating System MR Credits 4.1 and/or 4.2.
    1. Recycled wood products:
        a. Particleboard plywood cores.
    2. The manufacturer shall submit documentation (i.e. "Source of Materials", Invoices, Third Party Validation, etc.) for specified wood products purchased for this project providing recycled content.
        a. Where assemblies contain both recycled and non-recycled wood products, provide documentation of the weight of recycled wood products relative to the total weight of each assembly.
        b. Provide documentation of the cost of each component or assembly which contains recycled wood products. Provide percentages (by weight) and costs of post-consumer recycled material and pre-consumer recycled material within each component.

E. All steel used in the product fabrication shall comply with the recycled steel content requirements to contribute towards achievement of the USGBC LEED Green Building Rating System MR Credits 4.1 and/or 4.2.
    1. All steel used in the fabrication of laboratory cabinets, fume hoods and modular laboratory systems shall have a minimum of 25%recycled steel content, as defined by ISO 14021-1999, calculated as follows:
    2. (% of Post Consumer Recycled Steel Content by Weight) + 0.5 x (% of Pre-Consumer Recycled Content by Weight) >/= 20% (30%) (40%)
    3. Documentation:
        a. The manufacturer shall submit documentation (i.e. "Source of Materials", Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled content.
        b. Provide documentation of the cost of each component which contains recycled steel.
        c. Provide percentages (by weight) and costs of post-consumer recycled material and pre-consumer recycled material within each component.

1.11 WARRANTY

A. All products will be warranted to be free from defects in materials and workmanship for a period of five years following substantial completion. The manufacturer/dealer/subcontractor shall repair or replace any products (or parts thereof) that are found to be defective. Replacement will include any parts, labor, shipping, and travel expenses involved. Warranty replacement work must be scheduled in coordination with the client's academic/research schedule and may therefore require evening and/or weekend work.

B. Installation Warranty:
    1. Provide unconditional 2-year installation warranty commencing on substantial completion in addition to the manufacturer warranty.

2. Provide a site review with the designated District representative prior to expiration of installation warranty as a condition to end installation warranty period.

PART 2 PRODUCTS

2.1 WOOD LABORATORY CASEWORK AND TABLES

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
   1. CiF Lab Solutions, 53 Courtland Avenue, Vaughan, Ontario, Canada L4K 3T2 Tel: 905 738-5821.
   2. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
   3. Mott Manufacturing Ltd., 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825.
   4. Diversified Woodcrafts, Inc., 300 South Krueger Street, Suring, WI 54174 Tel: 920 842-2136.
   5. Pacific Cabinets Inc., 2010 Front Street, Ferdinand, Idaho 83526 Tel: 208 962-5546.
   6. Approved substitution/equal.

B. Quality Standards:
   1. Wood casework shall comply with all requirements of AWS Custom Grade architectural cabinets, unless otherwise specified in this section.

C. Design Requirements:
   1. Door and drawer design: Square edged full flush overlay design with eased edges. Applied panels may be required in areas such as sink cabinets and knee spaces with pencil drawers to complete the flush construction. Reveals shall be within the ranges indicated below; however, they shall be consistent across a given project.
      a. Reveal from top of door/drawer fronts to top of cabinet: 3/32 inch to 3/8 inch.
      b. Reveal from bottom of door/drawer fronts to bottom of cabinet bottom panel: Flush.
      c. Horizontal and vertical reveals between door and drawer fronts: 3/32 inch to 3/16 inch.
      d. Vertical reveal between side of door and drawer fronts and the side of the cabinet: one-half of the typical horizontal and vertical reveal.
   2. Pulls on doors shall be mounted vertically and on drawers horizontally.
   3. Grain Pattern:
      a. Vertical Matched Grain Pattern: Grain pattern on all exposed surfaces shall be vertical. Entire cabinet front must be cut from a single panel.
   4. Toe Kicks/ Toe Spaces:
      a. All tall storage cabinets to have toe space to match base units.
      b. Provide toe spaces at all fully-exposed sides of cabinets, including locations such as the end of island benches, the end of peninsula benches, and outside-corner cabinets. Toe spaces shall run continuously through all items such as knee opening side panels and end panels.
   5. Full-Flush Construction and Installation: All finished panels and surfaces shall be in the same plane as the front of cabinet doors/drawers to provide a true flush overlay appearance.
      a. Filler panels: Provide filler panels where casework units meet perpendicular walls to create a continuous appearance.
         1). Full-flush end-of-run filler panels are required at all conditions where the joint width is one inch or larger. At conditions where the joint width is less than one inch, filler panel should be flush with cabinet body.
      b. Flush panels: Provide fixed fully-edgebanded flush panels at sink cabinets, knee opening drawer units, filler panels, and elsewhere, so that all finished panels are in the same plane as cabinet doors and drawers to provide a true flush overlay appearance.
      c. Applied panels may be required in areas such as sink cabinets and knee spaces with pencil drawers to complete the flush construction.
      d. At outside corners, align side panel of cabinet with the face of the door of adjacent cabinet.
      e. At inside corners, mount filler panels flush with face of adjacent cabinet doors.
      f. At open cabinets (without doors), align face of cabinet with face of adjacent cabinet door. Adjust the depth of the cabinet and toe kick accordingly.
      g. Align other filler panels and applied panels with face of adjacent cabinet doors.
      h. Align face of end panels and knee-opening side panels with face of adjacent cabinet doors.

i. Provide filler/ trim panels at locations where undercounter dishwashers or glasswashers are shown and the units provided do not completely fill the opening indicated.
j. Filler panels shall follow the profile of toe kicks.

6. Extended Ends:
   a. At end-of-run base cabinets, provide extended end to cabinet to create closure to the wall without the use of filler panels. Extended end shall be edgebanded on front and bottom edges. Back edge shall be scribed to the wall with a tight hairline joint. Field-applied panels do not meet this requirement.
   b. At ends of island benches and peninsula benches, provide a paired set of base cabinets, each with an extended end, resulting in a single joint. These extended end panels shall be edgebanded on the front and bottom edges and shall meet at a hairline joint. Applied panels do not meet this requirement.
7. Flush interiors: Set cupboard bottom flush with front-end facers. Surface mounted bottoms and offsets caused by front face frames that interfere with ease of cleaning are not acceptable.
8. Widths of drawer bodies in knee opening rails shall not be less than 18 inches (457 mm). As noted above, applied panel shall be provided to complete the flush construction on either side of the drawer head.

D. Materials and Finishes:

1. Wood:
   a. Definition of cabinet components by surface visibility:
      1). Exposed Surfaces:
         a). Surfaces exposed when doors and drawers are closed.
         b). Surfaces visible when behind glass doors, including tops and bottoms of shelves.
         c). All exterior surfaces of suspended casework.
         d). Open units.
         e). Bottoms of cabinets if 42 inches (1070 mm) or more above finished floor.
         f). Tops of cabinets if less than 72 inches (1830 mm) above finished floor.
         g). Front rail of web frames.
      2). Semi-exposed surfaces:
         a). Surfaces that are visible when solid (opaque) doors are open or drawers are extended, including backs of doors.
         b). Tops of cabinets 72 inches (1830 mm) or more above finished floor when visible from an upper level.
      3). Unexposed surfaces:
         a). Surfaces not normally visible after installation with doors open and drawers extended.
         b). Bottoms of cabinets less than 30 inches (750 mm) above finished floor.
         c). Tops of cabinets over 78 inches (1980 mm) above finished floor and not visible from an upper level.
   b. Wood Species and Veneer Cut: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
   c. ~~Maple~~Base Bid and Alternate Bid:***ADD-2***
      1). Lumber:
         a). Exposed and semi-exposed:
            (1). Base Bid: Plain sawn Maple, NHLA Grade FAS. ***ADD-2***
            (2). Alternate Bid: Quarter Sawn Hickory, NHLA Grade FAS. Refer to Section 012300 for additional information. ***ADD-2***
         b). Unexposed: Select grade hardwood of a species suitable for the specified purpose.
         c). All lumber shall be clean and free of defects; kiln and air dried to uniform moisture content of 6 percent.
      2). Veneer:
         a). Exposed: Base Bid: Plain sliced white select maple, grade A. Alternate Bid: Quarter Cut Hickory, Basis of Design: Dooge Veneers; refer to Section 012300 for additIonal information. Thickness: 1/50 inch (0.5 mm), minimum. ***ADD-2***
            (1). Color and Matching:
               (a). 100% sapwood, no heartwood allowed.
               (b). Slight color streaks or marks.

(c). Slight color variation.
(d). No sharp contrast at veneer joints.
(2). Natural Characteristics:
(a). Small conspicuous burls: combined average not to exceed 4 per 10 square feet (1 m^2).
(b). Conspicuous burl size: 3/8 inch (9.5 mm), maximum.
(c). Conspicuous pin knots: combined average not to exceed 4 per 32 square feet (3 square meters). Maximum pin knot size – dark part: 1/8" (3.2mm). Maximum pin knot size – total: ¼" (6.4mm).
(d). Scattered sound repair knots, bark pockets: not allowed.
(e). Slight mineral streaks, worm tracks, cross bars and vine marks.
(3). Manufacturing Characteristics:
(a). Rough cut or ruptured grain is not allowed.
(b). Blended repaired tapering hairline Splits: two 1/16 inch (1.6 mm) x 6 inch (152 mm) on end panels only.
(4). Repairs: Small blending allowed.
(5). Flitch Width, Face Components: 5 inches minimum, except for outside components.

2. Plywood
   a. Typical, Unless Otherwise Noted: Hardwood Veneer Plywood
      1). Product shall be provided with hardwood face veneers as specified above.
      2). Plies:
         a). ¾ inch (19 mm): minimum 7-ply, including face veneers.
         b). 1 inch (25 mm): minimum 9-ply, including face veneer.
      3). Physical Properties:
         a). Screwholding: 355 lb at face.
         b). Average modulus of rupture: 7346 psi (50.65 N/mm^2).
   b. Drawer and Door Fronts: ANSI A208.1 M3 Grade Industrial Particleboard Core Plywood.
      1). Product shall be provided with hardwood face veneers as specified above.
      2). Plies:
         a). 3-ply, including face veneers.
      3). Minimum Physical Properties:
         a). Screwholding: 247 lbs at face, 225 pounds at edge.
         b). Average modulus of rupture: 2,393 lb/in2.
         c). Modulus of elasticity: 398,900 lb/in2.
         d). Hardness: 500 lbs.
   c. Drawer box back, front and sides: Finnish or Baltic Birch Plywood
3. Hardboard: Dry process S2S hardboard made from compressed exploded wood fibers.
4. Edgeband/Facer: 1/8" (3 mm) hardwood; species as described above.
5. Dowels: 8 mm, diameter, minimum, hardwood, laterally fluted with chamfered ends.
6. Glue: Type 2 or Type 3 water resistant glue with gluing done in clamps and jigs.
7. Finish for Wood Laboratory Components:
   a. All wood components shall be fully sanded on all surfaces including the underside of exposed components, glazed door element inside edges, penetrations for the attachment of drawer heads, screws attaching adjacent cabinets, cutouts at grilles, and all other such locations. The final installation shall present no rough, splintered, or unfinished surfaces at any visible, exposed, semi-exposed, or touchable locations. This does not apply to components of surfaces which will be fully concealed in the final installation.
   b. Finish processes (stains and finishes) shall be by means of compression spray or a UV roll coater, providing high-transfer efficiency low waste generation. Solvent applied coatings are not acceptable and will not be considered. Manufacturer shall supply documentation that waste generated during the finishing process, is a non-hazardous material, eliminating liquid waste disposal in landfills.
      1). Chemically Resistance Finish: Finish for all wood products shall be environmentally friendly, highly chemically resistant, water-borne, laboratory-grade finish that satisfies the requirements specified herein for chemical and durability resistance. A letter from a third-party validator, verifying independent test results, shall be submitted.

2). Operator Protection: The application shall be convenient and easily mastered, in a custom spray booth. The finish process shall be cleanly contained and shall have no solvent odor, and shall be applied in an air-conditioned room.
3). VOC Emissions: Water-borne finishes shall be sprayed and cured with a near zero (2.0 lbs. per gallon for 'clean finish') VOC (Volatile Organic Compounds) emissions.
4). Offgasing: After all wood products have cooled from the curing ovens, the coating shall be firm and stable. No further emissions or "Offgasing/Decomposition" vapors shall occur at room temperature.

c. Manufacturer may uses either of the following finish systems:
1). Customized, high-solids, cross-linked, ultraviolet light (UV)-cured coating developed for durability, including abrasion, chemical, impact, and scratch resistance, for flat-line applications. Coatings shall have little or no VOCs.
2). Chemical-resistant modified acrylic urethane finish with built-in UV blocker, or equal, applied over permanent wood stain.

d. Stain Color:
1). Base Bid: To be selected by Architect from manufacturer's full published color range. ***ADD-2***
2). Alternate Bid: Clear finish. Refer to Section 012300 for additional information. ***ADD-2***

e. Application:
1). Finish application and sequence shall be as recommended and designed by the manufacturer for a high quality, laboratory-grade wood casework finish.
2). Preparation: Sand exposed and semi-exposed surfaces smooth, free from dirt and defects.
3). Stain application: Apply stain of color selected to all exposed and semi-exposed casework surfaces. Apply in a manner to achieve a match with the selected color sample upon completion of application of the finish.
4). Finish application: Apply chemical resistant top finish to all stained surfaces. Apply to doors after any notching for hinges has been performed. Finished surfaces shall be even, water-clear and bright. Cloudy or muddy finishes carrying tinting pigments will not be acceptable.

8. Glass: Framed glass doors:
a. 1/8 inch (3mm) to 7/32 inch (5.5 mm) nominal tempered glass.
b. Without imperfections or marred surfaces.
c. All glass should have etched safety information, readable from outside the cabinet.

E. Construction:
1. Base Cabinets:
a. Assembly: Dowel and/or mortise-and-tenon joinery secured with countersunk screws and pressure-glued.
b. Cabinet Top:
1). L-shaped front rail of ¾" plywood: 1½ inches (38 mm) x 2¼ inches (57 mm); or horizontal front rail of 1 inch (25 mm) x 3 inches (76 mm) hardwood. Back rail: ¾" plywood or hardwood, 3-3/4" tall.
c. Cabinet Bottom: ¾ inch (19 mm) thick plywood. Set flush and join to cabinet end panels. Front edge shall be edgebanded.
d. Cabinets Ends/Sides, and Backs Exposed to View from the Outside: ¾ inch (19 mm) thick plywood.
1). Side panels and end panels: edgeband front edge and bottom edge.
e. Cabinet Backs, Exposed to View From the Inside at Open Units and Units with Glazed Doors: 1/4 inch (19 mm) thick veneer core plywood.
f. Cabinet Back, Semi-Exposed and Unexposed:
1). Removable hardboard, 1/4 inch (6 mm) thick.
2). Sink base back shall be half-height construction to allow for plumbing and sink waste connection.
3). Provide split back on drawer cabinets.
g. Cabinet Base: 3¾ inches (95 mm) x ¾ inch (19 mm) front hardwood or veneer core plywood toe space rail, mounted between end panels, forming a 4 inch (102 mm) high x 2½ inch (63 mm) deep toe space, closed to cupboard bottom. Secure rails to cabinet end panels.

h. Shelves: 1 inch (25 mm) thick full-depth, 9-ply hardwood plywood. Full-depth is defined as a shelf whose front edge is within ½ inch (13mm) of the face of the cabinet when the shelf is fully back in the cabinet.
   1). Front edge of shelves shall be edgebanded.
   2). Shelf Adjustment: All shelves shall be adjustable on 32 mm centers.
   3). Shelf Tolerance: Shelves shall fit into cabinets or into shelf supports with a tolerance of 1/16 inch per side maximum.

i. Drawer construction:
   1). Drawer box back, front and sides shall be of ½ inch (13 mm), 9-ply Finnish or Baltic Birch veneer plywood, with eased top edge, finished with a Gloss Level 7 polyester acrylic finish. The top edges of the completed drawer bodies shall be very smooth to the touch and shall not present any rough or splintered surfaces. Sides shall be full height with 1 inch (25 mm) clearance to frame opening. Drawers shall be a minimum of 18 inches front to back.
   2). Acceptable drawer joinery options:
      a). Dowel: Glued under pressure; 32mm, minimum, dowel spacing to 4 inches (102 mm) high, 64 mm dowel spacing above 4 inches (102 mm).
      b). Multiple Dovetail: Tight fitting and glued.
   3). Drawer bottom shall be Baltic Birch veneer plywood. Bottom shall be grooved into the 4 sided drawer box and sealed with hot melt glue process around entire drawer bottom perimeter.
      a). Drawers up to 24 inches wide: 3/8 inch (6mm) thick 7-ply Baltic Birch veneer plywood.
      b). Drawers greater than 24 inches wide: 1/2 inch (13 mm) thick 9-Ply Baltic Birch veneer plywood.

j. Door and Drawer Heads: shall be ¾ inch (19 mm) thick plywood with edgebanding. Edges shall be as specified previously in this section. Drawer heads shall be screwed to drawer box.

k. Flush Panels: As described in the Design Requirements section of this specification.

l. Front Horizontal intermediate Rail: ¾ inch (19 mm) x 1½ inches (38 mm) exposed hardwood rail shall be provided between doors and drawers. For all drawer units at benches where service fitting connections are not accessible via an adjacent knee opening filler or cabinet filler panel, drawer units to be provided with Keku fasteners (Keku fasteners not required at other locations). The drawer unit intermediate horizontal and vertical box frames must be removable. These components shall be assembled with Keku suspension fittings as manufactured by Häfele America Co. or approved so these members are easily removable at any time with no special tools to gain access to concealed piped services behind.

m. Intermediate Back Rail: 1½ inch (38 mm) x ¾ inch (19 mm) hardwood lumber to accept hardboard security panel between drawers.

n. Security Panels: Provide hardboard security panels, 1/8 inch (3 mm) thick, in frames when keyed-different locks are specified, or where individual padlock hasps are indicated. Inset security panel into frame on all four sides.

o. Where drawers are indicated to be removable and without ball bearing glides provide a drawer keel and a mating case channel, wherein weight loads are distributed over a three (3) point area. They shall be furnished one (1) pair on all drawers up to 24 inches wide, two (2) pairs on drawers over 24 inches wide. Drawer keels shall be 1-13/16 inches wide, chamfered to a 30 degree angle, allowing it to mate with the 3 inch wide case channel. Security panels, where required, shall be an integral part of this assembly. Removable horizontal intermediate rails and case channels shall be provided for all drawer units at benches where service fitting connections are not accessible via an adjacent knee opening filler or cabinet filler panel using components as described above. Provide a drawer stop mounted on top of the drawer back to prevent inadvertent drawer removal which can be manually released. Working parts of drawer stop to be made of corrosion resistant stainless steel and plastic. Plated metal stops subject to failure in a corrosive atmosphere are not acceptable.

2. Wall, upper and tall cases:
   a. Shall be manufactured with materials and joinery methods as specified for base units, unless otherwise indicated.
   b. Edgebanding:

1). Wall cabinets side panels: Edgeband front and bottom edges. Wall cabinet end panels: Edgeband front, bottom, and top edges.
2). Edgeband front, top, and bottom edges of tall cabinet side and end panels.

c. Cabinet Interior Backs: 1/4 inch thick veneer core plywood, typical for all exposed, and semi-exposed interior backs.
d. Hardwood plywood tops: 1 inch (25 mm) thick with front edge edgebanded.
e. Wall and upper case hardwood plywood bottoms: 1 inch (25 mm) thick. Tall case hardwood plywood bottoms ¾ inch (19 mm) thick. Edgeband front edges.
f. Bottom hardwood kick rail on tall cases: 3¾ inches (95 mm) x ¾ inch (19 mm) front hardwood or veneer core plywood toe space rail, mounted between end panels, forming a 4 inch (102 mm) high x 2½ inch (63 mm) deep toe space, closed to cupboard bottom. Secure rails to cabinet end panels.
g. Solid doors shall be the same construction as specified for base cabinets.
h. Framed-glazed doors: Hardwood construction, ¾ inch (19 mm) x 2¾ inch (70 mm) machined to accept glass. Ease all edges, interior and exterior, including those that frame the glazing. Provide extruded vinyl retaining molding on interior designed so glass can be replaced without tools
i. Shelves: 1 inch (25 mm) thick full depth, 9-ply hardwood plywood. Full-depth is defined as a shelf whose front edge is within ½ inch (13mm) of the face of the cabinet when the shelf is fully back in the cabinet.
    1). Front edge of shelves shall be edgebanded.
    2). Front edge of open shelves:
        a). Retainer Rail: Retainer rail as specified elsewhere in this section and detailed on drawings.
    3). Shelf adjustment:
        a). Wall units: All shelves shall be adjustable on 32 mm centers.
        b). General purpose tall units: One fixed shelf. All others shall be adjustable on 32 mm centers.
    4). For tall cabinets indicated with Dividers provide 3 equally spaced bent stainless steel ¼ inch rod dividers for each shelf and cabinet bottom positioned perpendicular to the long dimension of the shelves and bottom. Rod dividers to be 12 inch long x 2 ½ inches tall above surface, centered in the cabinet front to back, counter sunk into shelves, and bottom and secured with silicon sealant.

3. Wood-Framed Laboratory Tables
    a. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.
    b. Vibration absorbing isolation: Provide a continuous wide bead of clear silicone sealant to the top of all supporting rails. Allow complete cure before attachment of the work surface.
    c. Electrical receptacles: Where indicated on the Laboratory Furnishings or Electrical drawings provide cutouts for electrical receptacles as work of this Section and coordinate with Division 26. Cord, plug, back boxes, electrical devices, faceplates, wiring, and junction boxes shall be provided under the work of Division 26
    d. Leveling Glide and Leg Shoe: Each leg other than those fitted with casters, shall have leveling glides and leg shoes.
        1). Leveling glides: (2 inch) (48 mm) diameter, two-piece pivot construction, steel housing, nonmarring, phenolic or translucent plastic insert, (1/2 inch) (12 mm) diameter, minimum (1 1/2 inch) (36 mm) long zinc plated stems. Each glide shall have a load bearing capacity of 150 lbs.
        2). Leg shoe: Black coved vinyl or rubber leg shoe, 2 inches (50 mm) in height.
    e. Casters: Where indicated on Laboratory Furnishing drawings, provide sets of 3 ½ inch (89 mm) diameter wheels with self-lubricating bearing, rated to carry 250 pounds (113 kg) minimum each. Each caster must swivel and have a locking brake at front wheels. Wheel shall be of molded polyurethane tread mechanically locked to a polyolefin core. Moveable tables to have all 4 swivel and locking casters.
    f. Rails: Not less than ¾ inch x 4-5/16 inch (19 x 110 mm) solid lumber with attached heavy duty steel corner braces, grooved and screwed into both rails at each corner. Groove rails for "Z" irons or drill for top attachment.
    g. Reinforcing cross rails: Hardwood lumber doweled and glue into front and back rails and pinned at intervals not more than 33 inches (838 mm) on center in tables without drawers.

h. Legs: Not less than 2 inch x 2 inch (50 x 50 mm).
   1). Construction: Either of the following is acceptable:
      a). Made of one solid piece of lumber
      b). Made from two pieces of solid lumber glued together. Individual components shall be carefully selected for color match. The glue joint shall be on the diagonal of the leg, as seen in plan. All legs shall be oriented so that the diagonals converge to create an "X" in plan.
   2). Veneered lumber or wood of any type is not acceptable for leg components.
i. Leg rails and spreader rail: Not less than 1¼ inch x 2½ inch (32 x 63 mm) hardwood lumber.
j. All exposed edges of legs and rails shall be eased, sanded smooth, and finished per the requirements for wood laboratory casework components.

4. Aprons and leg assemblies:
   a. Apron: Not less than ¾ inch (19 mm) x 4-5/16 inch (110 mm) hardwood.
   b. Legs: Not less than 2 inch (50 mm) x 2 inch (50 mm) hardwood.
   c. Leg rails: Not less than 1¼ inch (32 mm) x 2½ inch (63 mm) hardwood.
   d. All exposed edges of legs and aprons shall be eased, sanded smooth, and finished per requirements described above for wood laboratory casework components.
5. Fume Hood Cabinets:
   a. Purpose-designed wood cabinet with fixed panel above door to conceal cup sink and plumbing.
   b. Provide wood fume hood cabinets where adjacent cabinetry below a fume hood is wood.
6. Wood Casework Construction Performance:
   a. Base cabinets shall be constructed to support a uniformly distributed load of 200 lbs. minimum per square foot (1000 kg/m²) of cabinet top area (total maximum of 2000 lbs. (900 kg)), including working surface, without permanent distortion or interference with door and drawer operation.
   b. Base cabinets shall be constructed so that when supported on both back corners and one front corner; with a counterweight load of 350 pounds placed on the rear corner behind the supported front corner; and with a load of 200 pounds placed on the unsupported corner – there shall be no permanent damage after 24 hours of loading. Maximum allowable deflection shall not exceed 1/8 inch.
   c. Swinging doors mounted on base units shall support a 200 lb. (113 kg) load located at a test point 12 inches (305 mm) measured horizontally from hinge along the top edge of door through a swing of 160 degrees. Weight test shall allow nominal temporary deflection, but no permanent distortion. Door assembly shall be twist- resistant and rigid, and shall close in a flat plane against the cabinet to permit the door catch at top of door to function properly.
   d. Drawers shall be constructed so that they will support a 150 pound load hung on the drawer head centerline, with the drawer opened 13 inches (330mm), for five minutes. There shall be no interference with the normal operation of the drawer and the drawer head should remain tightly fastened to the drawer.
   e. Drawers shall be constructed so that a drawer that is removed and supported on four corners will support a 10 pound sand or shot bag dropped from a height of 24 inches (610mm) without damage.
   f. Drawers shall be constructed so that a drawer that is removed and supported at a 45 degree angle shall be capable of withstanding three impacts of a 2 inch (51mm) diameter, 12 inch (305mm) long steel rod (approximately 10 pounds in weight) released from 13 inches (330mm) from the front and back of the drawer. The drawer joinery shall remain intact and the drawer shall operate normally when placed back into the casework cabinet.
   g. Drawers mechanical suspension systems shall be designed and attached to that a drawer uniformly loaded with 75 pounds of sand or shot bags shall operate freely without binding over its full range for 50,000 cycles at a rate not exceeding 10 cycles per minute. The force required to open and close the loaded drawer for the purposes of this test shall not exceed 8 pounds.
   h. Shelves shall be designed and supported to that they can support a load of 40 pounds per square foot, up to a maximum of 200 pounds per shelf, for 24 hours with no more than 0.35 inches (9mm) of deflection maximum.

F. Hardware: As specified elsewhere in this Section.

G. Wood Finish Chemical Resistance Performance Requirements:

1. Manufacturer shall submit wood finish chemical resistance performance test results. Testing to be performed by independent testing agency.
2. Procedure: Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods. For both methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM.
   a. Method A: Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.
   b. Method B: Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, concave side down.
3. Rating System: Evaluations shall use the following rating system:

Level 0	No detectable change.
Level 1	Slight change in color or gloss.
Level 2	Slight surface etching or severe staining.
Level 3	Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

4. Acceptance Level:
   a. Individual test results for the specified 49 reagents shall be within the Range for that reagent as specified on the table below.
   b. There shall be no more than four (4) Level 3 conditions.
5. Table of reagents:

Test No.	Chemical Reagent	Test Method	Range
1.	Acetate, Amyl	A	0-1
2.	Acetate, Ethyl	A	0-1
3.	Acetic Acid, 98%	B	0-1
4.	Acetone	A	0
5.	Acid Dichromate, 5%	B	0-1
6.	Alcohol, Butyl	A	0-1
7.	Alcohol, Ethyl	A	0
8.	Alcohol, Methyl	A	0-1
9.	Ammonium Hydroxide, 28%	B	0-2
10.	Benzene	A	0-1
11.	Carbon Tetrachloride	A	0-1
12.	Chloroform	A	0
13.	Chromic Acid, 60%	B	0-1
14.	Cresol	A	0-2
15.	Dichloroacetic Acid	A	0-3
16.	Dimethylformamide	A	0-2
17.	Dioxane	A	0-1
18.	Ethyl Ether	A	0-1
19.	Formaldehyde, 37%	A	0
20.	Formic Acid, 90%	B	0-1
21.	Furfural	A	0-1
22.	Gasoline	A	0
23.	Hydrofluoric Acid, 37%	B	0-2
24.	Hydrofluoric Acid, 48%	B	0-2
25.	Hydrogen Peroxide, 30%	B	0-1
26.	Iodine, Tincture of	B	0-2
27.	Methyl Ethyl Ketone	A	0
28.	Methylene Chloride	A	0-1
29.	Monochlorobenzene	A	0-1
30.	Naphthalene	A	0
31.	Nitric Acid, 20%	B	0
32.	Nitric Acid, 30%	B	0-2
33.	Nitric Acid, 70%	B	2-3

Test No.	Chemical Reagent	Test Method	Range
34.	Phenol, 90%	A	0-2
35.	Phosphoric Acid, 85%	B	0-1
36.	Silver Nitrate Saturated	B	0-1
37.	Sodium Hydroxide 10%	B	0-2
38.	Sodium Hydroxide 20%	B	0-2
39.	Sodium Hydroxide 40%	B	0-2
40.	Sodium Hydroxide Flake	B	0
41.	Sodium Sulfide Saturated	B	0
42.	Sulfuric Acid, 33%	B	0-1
43.	Sulfuric Acid, 77%	B	0-1
44.	Sulfuric Acid, 96%	B	1-3
45.	Sulfuric Acid 77% & Nitric Acid 70% equal parts	B	1-3
46.	Toluene	A	0
47.	Trichloroethylene	A	0
48.	Xylene	A	0
49.	Zinc Chloride, Saturated	B	0

2.2 METAL LABORATORY CASEWORK AND TABLES

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer. Corrosive and flammable liquid/solvent storage cabinets may also be provided by the manufacturers listed with their descriptions.

1. Laboratory Casework:
   a. Air Master Systems, 6480 Norton Center Drive, Muskegon, MI 49441 Tel 231 798-1111.
   b. Bedcolab Ltd, 2305 Francis Hughes Avenue, Laval, Quebec, Canada H7S 1H5 Tel 514 384-2820.
   c. CiF Lab Solutions, 53 Courtland Avenue, Vaughan, Ontario, Canada L4K 3T2 Tel: 905 738-5821.
   d. Jamestown Metal Products, Inc., 178 Blackstone Avenue, Jamestown, NY 14701 Tel: 716 665-5313.
   e. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
   f. Mott Manufacturing Ltd., 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825
   g. Approved substitution/equal.

B. Metal Laboratory Casework

1. Design Requirements:
   a. Door and drawer front design: Square edged inset metal construction with all front surfaces above the toe space in the same plane.
   b. Pulls on doors shall be mounted vertically and on drawers horizontally.
   c. All tall cases shall be provided with toe space to match base units.
   d. All cabinets shall be constructed and finished to be suitable for use as stand-alone units and to permit future rearrangement without the need for additional parts or finish.
   e. Widths of drawers in knee opening rails shall not be less than 24 inches (600 mm) or the width of the rail whichever is the lesser.
   f. Cabinets below fume hoods that conflict with ductwork, cup sinks, or waste connections shall be 19 inches deep to accommodate any obstructions.
2. Materials:
   a. Steel: Cold-rolled furniture stock sheet steel, prime grade, roller leveled.
      1). Steel shall be treated at the mill to be free of scale, ragged edges, deep scratches, or other injurious effects.
      2). All gauges indicated are to be U.S. standard.
   b. Glass: Framed glass doors:
      1). 1/8 inch (3mm) to 7/32 inch (5.5 mm) nominal tempered glass.
      2). Without imperfections or marred surfaces.
      3). All glass should have etched safety information, readable from outside the cabinet.

3. Base, Wall, Upper, and Tall Cabinets:
   a. General:
      1). Exterior corners: shall be spot and arc welded with heavy back up reinforcement at exterior corners. All face joints shall be arc welded and ground smooth to provide a continuous flat plane.
      2). All units shall have a cleanable smooth interior. Front and rear posts, reinforcing members or channel uprights shall be enclosed full heights on all cabinet openings.
      3). End Uprights shall be formed into not less than a channel formation at top, bottom, back and front.
      4). The edge of the vertical uprights shall be formed to provide a strike for doors and drawers, and shall be perforated for the support of drawer channels, intermediate rails and hinge screws.
      5). An upright filler shall be screwed in place in all cupboard units to close the back of the channel at front of the upright and to provide a smooth interior for the cupboard to facilitate cleaning.
      6). The upright filler shall be perforated with shelf adjustment holes at no more than ½ inch (12.7 mm) centers.
      7). The inside front of the upright shall be further reinforced with a full height 14 gauge (2.0 mm thick) hinge reinforcement angle.
      8). Die Formed Gussets: shall be furnished in each bottom corner of base units to insure rigidity, and a 3/8 inch (10 mm) -16 leveling bolt, 3 inches (75 mm) long, shall engage a clinch nut in each gusset. Each leveling bolt and gusset shall be capable of supporting 500 lbs (225 kg). (Each unit shall support 2000 lbs. (900 kg) uniformly distributed on a work top.) Provide caps at all penetrations provided to access leveling devices.
   b. Cabinet Base:
      1). Case bottom and bottom rail shall be formed of one piece of metal except in corner units and shall have both sides and back formed up or down and shall be offset in front to provide a door and drawer recess rabbet.
      2). Toe Space Rail: shall extend up and forward to engage bottom rail to form a smooth surfaced toe space, 3 inches (75 mm) deep and 4 inches (100 mm) high. Whenever the base is omitted for units to be set on building bases or separate metal bases, the toe space rail shall extend back 4½ inches (115 mm).
   c. Cabinet Back, Unexposed: Cabinet back shall consist of a top and bottom rail, channel formed for maximum strength and welded to back and top flange of end uprights, with space between left open for access to plumbing lines. All units shall be provided with removable back panels.
      1). Sink units shall be provided with fixed half-height backs to allow plumbing lines to enter and exit the cabinet through the open area.
   d. Shelves: shall be full depth formed down ¾ inch (19 mm), back 7/8 inch (22 mm) and up ¼ inch (6 mm) at front and rear and formed down at ends ¾ inch (19 mm). Shelves over 36 inches (914 mm) in length shall be additionally reinforced by a flanged channel shaped member electro-welded to underside of shelf. Shelves shall be adjustable. Full-depth is defined as a shelf whose front edge is within ½ inch (13mm) of the face of the cabinet when the shelf is fully back in the cabinet.
      1). Restraint: At open tall shelf units, provide retainer rail as specified elsewhere in this section and detailed on drawings.
   e. Doors: shall be readily removable and hinges easily replaceable. Hinges shall be applied to the case and door with screws. Welding of hinges to either case or door will not be acceptable.
   f. Door and Drawer Heads:
      1). Metal, Flush Inset: shall be a two-piece sheet steel assembly of ¾ inch (19 mm) overall thickness to consist of an inner pan formed as an extension of the drawer body, an outer pan having a channel formation on all four sides, and the interior space filled with a non-organic sound deadening material at the time of assembly. Door Pans and Drawer Heads shall be painted inside and out prior to assembly.
         a). All four corners of door and drawer heads shall be welded closed and ground smooth to eliminate exposure of raw edges and open gaps.
         b). Glazed Hinged Door Contruction: Glazed swinging doors shall be 3/4" thick and consist of an inner and outer door pan welded to form a single unit. Outer door pan

shall be 18 gauge steel, formed into a channel or flanged shape at all four sides. It shall be pierced and formed to create a 3" wide frame with a beveled edge around the glass opening in the center of the door. Inner door pan shall be 18 gauge steel, flanged at all four sides, pierced for a glass opening in center of the door, with 16 gauge hinge reinforcements welded in place. Glazing shall be held in place by a rubber or vinyl gasket around the entire edge of the glass. Outer door pan shall be prepared as necessary to accept attachment of pulls as specified elsewherein this section.

g. Drawer Construction:
   1). Drawer bodies shall be made in one-piece construction including the bottom, two sides, back and inner front. They shall be fully coved at interior bottom on all four sides for easy cleaning. Sides shall be full height with ½ inch (13 mm) clearance to frame opening. Drawers shall be a minimum of 18 inches front to back.
   2). Drawer Suspension: Refer to Drawer Slides under Hardware section.
   3). Drawer stops: shall be provided to insure smooth, quiet operation at point of contact with cabinet front.

h. Top Horizontal Rail: Provide on base cabinets such that rail shall interlock within the flange at top of end panels for strength. Reinforcements shall be provided at all front corners for additional welded strength between vertical and horizontal case members.

i. Intermediate Rails: Provide on base cabinets such that rails shall be provided between doors and drawers, but shall not be provided between drawers unless made necessary by locks in drawers. When required, intermediate rails shall be recessed behind doors and drawer fronts, and designed so that security panels may be added as required.

j. Intermediate Vertical Uprights: shall be furnished to enclose cupboards when used in a unit in combination with a half width bank of drawers. However, to allow storage of large or bulky objects, no upright of any type shall be used at the center of double door cupboard units.

k. Security Panels: Provide security panels in frames between drawers and cabinets within a cabinet where keyed different locks are indicated.

l. Knee Space Service Strip Cover Panels where specified, shall be 18 gauge (1.3 mm thick) steel, of the same finish as cabinets, and shall be furnished at open spaces under counter top where no cabinets occur. They shall be easily removable and shall cover piping from underside of top of service ledge to floor.

m. Provide filler panels where required between cabinets, at corner intersections of cabinets, between cabinets and walls and wherever else required for a complete finished installation. For tall cabinets, filler panels shall be provided for vertical face and top. For wall cabinets, filler panels shall be provided for vertical face, top and bottom. Filler panels shall follow the profile of toe kicks.

4. Metal-Framed Laboratory Tables
   a. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.
   b. Vibration absorbing isolation: Provide a continuous wide bead of clear silicone sealant to the top of all supporting rails. Allow complete cure before attachment of the work surface.
   c. Electrical receptacles: Where indicated on the Laboratory Furnishings or Electrical drawings provide cutouts for electrical receptacles as work of this Section and coordinate with Division 26. Cord, plug, back boxes, electrical devices, faceplates, wiring, and junction boxes shall be provided under the work of Division 26.
   d. Leveling Glides and Leg Shoes:
      1). Each leg other than those fitted with casters shall have leveling glides: (2 inch) (48 mm) diameter, two-piece pivot construction, steel housing, nonmarring, phenolic or translucent plastic insert, (1/2 inch) (12 mm) diameter, minimum (1 1/2 inch) (36 mm) long zinc plated stems. Each glide shall have a load bearing capacity of 150 lbs.
      2). Each leg other than those fitted with casters and adjustable-height legs, shall have leg shoes: Black coved vinyl or rubber leg shoe, 2 inches (50 mm) in height.
   e. Construction:
      1). Table rails, legs, and spreader rails (where shown) shall be fully welded into a single-piece table frame structure. No mechanical joints between members are permitted.
   f. Rails: Not less than 1½ inch x 4½ inch 16 gauge (38 x 114 x 1.6 mm) channel steel sections, reinforced as necessary for leg attachment.
   g. Legs: Not less than 2 inch x 2 inch 16 gauge (50 x 50 x 1.6 mm) square tubular steel sections.

h. Where shown, leg rails and spreader rail: Not less than 1¼ inch x 2½ inch 16 gauge (32 x 63 x 1.6 mm) steel sections, reinforced as necessary for leg attachment.
i. Materials and Finish: Refer to Metal Fabrications specifications in this Section for material and finish requirements.
j. Low level shelf: If shown on Laboratory Furnishing drawings shall be of 20 gauge (1.0 mm thick) steel sheet with perimeters formed down ¾ inch (19 mm). Shelves over 36 inches wide shall be reinforced by a flanged channel shaped member electro-welded to underside of shelf.

5. Aprons and leg assemblies:
   a. Apron: Not less than 1½ inch (38 mm) x 4 inch (114 mm) 16 gauge (x 1.6 mm thick) channel steel sections, reinforced as necessary for leg attachment.
   b. Legs: Not less than 2 inch (50 mm) x 2 inch (50 mm) 16 gauge (x 1.6 mm thick) square tubular steel sections.
   c. Leg rails: Not less than 1¼ inch (32 mm) x 2½ inch (63 mm) 16 gauge (x 1.6 mm thick) steel sections, reinforced as necessary for leg attachment. Each leg shall have a recessed leveling screw and a black, coved vinyl or rubber leg shoe, 2 inches (50 mm) in height.
6. Fume Hood Cabinets:
   a. Purpose-designed metal cabinet with fixed panel above door to conceal cup sink and plumbing.
   b. Provide metal fume hood cabinets where adjacent cabinetry below a fume hood is also metal.
7. Corrosives Storage Cabinets:
   a. Manufacturers:
      1). Manufacturers of metal laboratory casework.
      2). Justrite Manufacturing Company, 2454 Dempster St., Suite 300, Des Plaines, IL 60016 Tel: 800 798-9250.
      3). Approved substitution/equal.
   b. Purpose-designed lined metal cabinet.
   c. Lining: All interior surfaces of the cabinet shall be coated with a 100% seamless non-porous flame-coated thermoplastic liner. Liner shall be applied to all interior walls, ceiling, sump, door interiors, and shelving. Basis of design: Justrite Chemcor. No known equal.
      1). Shelf: Removable adjustable full-depth metal shelf coated with lining material. Full-depth is defined as a shelf whose front edge is within ½ inch (13mm) of the face of the cabinet when the shelf is fully back in the cabinet.
   d. Label: "CORROSIVES" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match the Flammable Liquid/Solvent Storage Cabinet label. Lettering shall be 2 ½ inches tall. Color of lettering shall be red. If cabinet color is red, lettering shall be yellow.
   e. Locks: Cabinet doors shall be lockable. Lock shall have not metal parts exposed within the lined interior.
   f. Venting:
      1). Cabinets below or adjacent to fume hoods: Provide and install 2 inch (50 mm) diameter schedule 40 PVC vent pipe and PVC fittings. Termination of vent pipe maybe one of the following:
         a). Extend vent pipe 4 inches (100 mm) above dished worktop, behind the baffle in the hood, as shown on the drawings. Provide hole through fume hood work surface above the corrosive storage cabinet to accommodate 2 inch (50 mm) diameter vent pipe. Seal gap around penetration with clear silicone sealant.
         b). Extend vent pipe up within the fume hood side wall and vent through the hood side wall liner behind the upper portion of the fume hood baffle.
      2). Cabinets not below or adjacent to fume hoods: Vent connection to exhaust duct system shall be by Division 23. Provide hole in back of cabinet to accept exhaust connection.
   g. Seismic Anchor: Provide seismic anchor for freestanding cabinets and cabinets located below fume hoods designated to be removable for access for persons with disabilities. Seismic anchors may be floor or wall attachments, but shall not attach to adjacent casework or work surfaces. Seismic anchors shall be accessible without removal of laboratory casework, furnishings, or equipment.
8. Flammable Liquid/Solvent Storage Cabinets:
   a. Manufacturers:
      1). Manufacturers of metal laboratory casework.

2). Eagle Manufacturing Company, 2400 Charles St., Wellsburg, WV 26070 Tel: 304 737-3171.
3). Justrite Manufacturing Company, 2454 Dempster St., Suite 300, Des Plaines, IL 60016 Tel: 800 798-9250.
4). Approved substitution/equal.

b. Purpose-designed double-walled metal cabinet for the storage of flammable, combustible and solvent liquids.
c. Cabinet doors: Well-fitting, metal, self-closing and self-latching with fusible lead links and door sequencer.
d. Label: "FLAMMABLE - KEEP FIRE AWAY" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match that of the Corrosive Storage Cabinet label. “FLAMMABLE” lettering shall be 2 ½ inches tall. “KEEP FIRE AWAY” lettering shall be 2 inches tall. Color of lettering shall be red. If cabinet color is red, lettering shall be yellow.
e. Locks: Cabinet doors shall be lockable.
f. Floor pan: Provide a 2 inch (50 mm) deep liquid tight pan to cover the entire bottom of the cabinet to contain liquid leaks and spills.
g. Shelves: Provide heavy-duty full-depth metal shelves using pan-type construction to create a liquid-tight containment tray.
h. Casters: Provide cabinets with lockable casters where indicated on the Laboratory Furnishing drawings.
i. Standards:
1). Comply with the requirements of OSHA and NFPA 30.
2). Comply with the requirements of Uniform Fire Code and the International Fire Code with with UL 1275 and FM 6050 labels.
j. Flammable liquid/solvent storage (base) cabinets shall not be vented. Seal vent openings with bungs as provided by manufacturer.
k. Venting of tall cabinets:
1). Remove both metal bungs from cabinet outlets and replace with flash arrestors provided by manufacturer. Connection with 2 inch (50 mm) black iron vent piping to the HVAC systems as shown on LF drawings shall be by Division 23.
2). Vents from multiple cabinets shall not be manifolded prior to connection to the building system.
l. Electrical grounding:
1). Provide each flammable liquid / solvent storage cabinet with an externally mounted grounding conductor screw terminal for up to #8 AWG conductor, mounted at the top of the cabinet.
2). Connection from the equipment grounding bus at the lab branch circuit panel to the storage cabinet terminal shall be by Division 26.
m. Seismic Anchor: Provide seismic anchor for freestanding cabinets and cabinets located below fume hoods designated to be removable for access for persons with disabilities. Seismic anchors may be floor or wall attachments, but shall not attach to adjacent casework or work surfaces. Seismic anchors shall be accessible without removal of laboratory casework, furnishings, or equipment. Anchor attachment shall not void UL listing.

9. Metal Casework Construction Performance: Base cabinets shall be constructed to support a uniformly distributed load of 200 lbs. minimum per square foot (1000 kg/m²) of cabinet top area (total maximum of 2000 lbs. (900 kg)), including working surface without objectionable distortion or interference with door and drawer operation.
a. Base cabinet corner gussets with leveling bolts shall support 500 lbs. (225 kg) per corner, at 1½ inch (38 mm) projection of the leveling bolt below the gusset.
b. Each adjustable and fixed shelf 4 feet (1219 mm) or shorter in length shall support an evenly distributed load of 40 lbs. per square foot (200 kgf/m²) up to a maximum of 200 lbs. (90 kg), with nominal temporary deflection, but no permanent set.
c. Drawer assemblies shall automatically maintain alignment in cabinet opening and shall not bind during opening or closing of the drawer so as to minimize glass breakage and damage to fragile parts.
d. Swinging doors mounted on base units shall support a 250 lb. (113 kg) load located at a test point 14 inches (356 mm) measured horizontally from hinge along the top edge of door through a swing of 180 degrees. Weight test shall allow nominal temporary deflection, but no

permanent distortion. Door assembly shall be twist- resistant and rigid, and shall close in a flat plane against the cabinet to permit the door catch at top of door to function properly.

C. Hardware: As specified elsewhere in this Section.

D. Metal Casework Color: As selected by the Architect from manufacturer's full color line and complying with finish requirements described below.

E. Metal Casework Finish Requirements:

1. Paint finish for steel laboratory products shall utilize a dry coating process with minimal waste generation. Liquid-applied coatings shall not be acceptable. Manufacturer shall supply documentation that waste generated during the painting process, is a solid, non-hazardous material.
   a. Pretreatment: Finish process shall incorporate a phosphate conversion coating during the pretreatment/cleaning operation.
   b. Operator Protection: The painting process shall be cleanly contained, have no solvent odor and be performed in an air-conditioned room.
   c. VOC (Volatile Organic Compounds) emissions shall not exceed 0.29 lbs per gallon (35 g/L).
   d. Offgasing: No further emissions or “Offgasing/Decomposition” vapors shall occur at room temperature from installed finished parts.
2. Preparation: After the units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish to the metal and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a heated cleaner/phosphate solution and pretreated with iron phosphate spray followed by a neutral final seal prior to application of final finish. The strength of each solution shall be monitored by filtration to insure consistent quality. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.
3. Application: Electrostatically apply powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:
   a. All surfaces, exterior or interior, exposed to view, shall receive sufficient powder coat to achieve an average 1.5 mil (38 µm) film thickness with a minimum 1.2 mil (30 µm) film thickness and shall have smooth satin luster.
   b. Backs of cabinets and other surfaces not exposed to view shall have sufficient powder coat to achieve an average 1.0 mil (25 µm) film thickness.
4. All drawer bodies to be finished in matching color or in a uniform neutral color.
5. Concealed interior parts shall receive corrosion-resistant treatment.
6. Finish must be UV stable.

F. Metal Finish Performance Requirements:

1. Manufacturer shall submit metal finish performance testing results. Testing to be performed by independent testing agency.
2. Chemical resistance:
   a. Test procedure: Place samples on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73+ 3F (23(+ 2(C) and 50+ 5% relative humidity, or the currently accepted guideline set by ASTM. Test the samples for chemical resistance using forty-nine different chemical reagents by one of the following methods. For both methods, leave the reagents on the sample for a period of one hour. Wash off the sample with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73± 3°F (23°± 2°C) and 50± 5% relative humidity, or the currently accepted guideline set by ASTM
      1). Method A: Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the sample. The cotton ball shall remain in contact with the sample for the duration of the test.
      2). Method B: Test non-volatile chemicals by placing five drops of the reagent on the surface of the sample and covering with a 24mm watch glass, convex side down.
   b. Rating System: Evaluations shall use the following rating system:

Level 0	No detectable change.

Level 1	Slight change in color or gloss.
Level 2	Slight surface etching or severe staining.
Level 3	Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

c. Acceptance Level:
   1). Individual test results for the specified 49 reagents shall be within the Range for that reagent as specified on the table below.
   2). There shall be no more than four (4) Level 3 conditions.

d. Table of reagents:

Test No.	Chemical Reagent	Test Method	Range
1.	Acetate, Amyl	A	0-1
2.	Acetate, Ethyl	A	0-2
3.	Acetic Acid, 98%	B	0-3
4.	Acetone	A	0-1
5.	Acid Dichromate, 5%	B	0-1
6.	Alcohol, Butyl	A	0-1
7.	Alcohol, Ethyl	A	0-1
8.	Alcohol, Methyl	A	0-1
9.	Ammonium Hydroxide, 28%	B	0
10.	Benzene	A	0-2
11.	Carbon Tetrachloride	A	0-1
12.	Chloroform	A	0-2
13.	Chromic Acid, 60%	B	0-2
14.	Cresol	A	0-2
15.	Dichloroacetic Acid	A	0-3
16.	Dimethylformamide	A	0-2
17.	Dioxane	A	0-2
18.	Ethyl Ether	A	0-1
19.	Formaldehyde, 37%	A	0-1
20.	Formic Acid, 90%	B	0-3
21.	Furfural	A	0-3
22.	Gasoline	A	0
23.	Hydrofluoric Acid, 37%	B	0-2
24.	Hydrofluoric Acid, 48%	B	0-3
25.	Hydrogen Peroxide, 30%	B	0-1
26.	Iodine, Tincture of	B	0-2
27.	Methyl Ethyl Ketone	A	0-2
28.	Methylene Chloride	A	0-2
29.	Monochlorobenzene	A	0-2
30.	Naphthalene	A	0-1
31.	Nitric Acid, 20%	B	0-1
32.	Nitric Acid, 30%	B	0-1
33.	Nitric Acid, 70%	B	0-3
34.	Phenol, 90%	A	0-2
35.	Phosphoric Acid, 85%	B	0-1
36.	Silver Nitrate Saturated	B	0
37.	Sodium Hydroxide 10%	B	0
38.	Sodium Hydroxide 20%	B	0
39.	Sodium Hydroxide 40%	B	0-1
40.	Sodium Hydroxide Flake	B	0
41.	Sodium Sulfide Saturated	B	0
42.	Sulfuric Acid, 33%	B	0
43.	Sulfuric Acid, 77%	B	0
44.	Sulfuric Acid, 96%	B	2-3
45.	Sulfuric Acid 77% & Nitric Acid 70% equal parts	B	1-3
46.	Toluene	A	0-1
47.	Trichloroethylene	A	0-1

Test No.	Chemical Reagent	Test Method	Range
48.	Xylene	A	0-1
49.	Zinc Chloride, Saturated	B	0

3. Hot Water Test
   a. Test Procedure: 190°F to 205°F (88°C to 96°C) hot water shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.5 cc) per minute) on the finished surface, which shall be set at an angle of 45°, for a period of 5 minutes.
   b. Acceptance Level: After cooling and wiping dry, the finish shall show no visible effect from the hot water.
4. Paint Adhesion on Steel Test
   a. Test Procedure: Test shall be based on ASTM D2197-86 “Standard Method of Test for Adhesion of Organic Coating.” Two sets of eleven parallel lines 1/16 inch (1.587 mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid to 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush surface lightly with a soft brush for one minute. Examine under 100 fc (1076 lux) of illumination.
   b. Acceptance Level: Ninety or more of the squares shall show finish intact.
5. Impact Test
   a. Test Procedure: Drop a 1 lb (0.4536 kg) ball (approximately 2 inch (50.8 mm) diameter from a distance of 12 inches (305 mm) onto a flat horizontal surface, coated to manufacturer’s standard manufacturing method.
   b. Acceptance Level: No visual evidence to the naked eye of cracks in the finish due to impact.
6. Paint Hardness on Steel Test
   a. Test Procedure: Paint film shall be tested with pencils of various hardnesses. Pencils shall have a wide, sharp edge. Pencils shall be pushed across surface in a chisel-like manner.
   b. Acceptance Level: Finish film shall not rupture from a sharpened 4H pencil.

G. Shop Casework
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
   a. Greene Manufacturing, Inc., 3985 South Fletcher Road, Chelsea, MI 48118 Tel: 800-396-4642. Manufacturer of Dura-Tech product range.
   b. Lista International Corporation, 106 Lowland Street, Holliston, MA 01746-2094 Tel: 800-722-3020.
   c. Approved substitution/equal.
2. Modular Shop Cabinets
   a. Basis of Design: Dura-Tech Modular Technical and Industrial Cabinets, or equivalent.
   b. Cabinet Requirements:
      1). Heavy duty load rated construction.
      2). All welded case and frame construction.
      3). Outer shell is constructed from 16 gauge furniture grade steel utilizing all welded construction.
      4). Bases are equipped standard with a 4” high recessed riser base including floor leveler glides.
      5). Full extension drawer glides rated for a minimum 125 lb up to 400 lb capacity.
      6). Drawer and door facings are full inner and outer headers securely welded together.
      7). All drawer components are formed from 18 gauge furniture grade steel.
      8). Door base cabinets feature an interior adjustable shelf.
      9). Cabinet shells are one piece side, back, and face frame.
      10). Wall cabinets feature all welded construction from 16 and 18 gauge steel and a full face frame with welded seams.
      11). 16 gauge interior shelves.
      12). Hardware:
         a). Provide satin finish stainless steel five-knuckle institutional grade hinges.
         b). Three-point cylinder locks as indicated on drawings and as specified elsewhere in this section.
         c). Pulls shall be stainless steel round “wire” as specified elsewhere in this section.
      13). Work surfaces as specified elsewhere in this section.

2.3 CABINET HARDWARE

A. General: Special cabinets, such as corrosives storage, flammable liquid and solvent storage, rock storage, map storage, museum storage, radioisotope storage, and narcotics lockers, may be provided with the manufacturer's standard hardware.
   1. All door and drawer pulls shall match, regardless of type of casework, except for:
      a. Polypropylene casework. Refer to the pull requirements as specified above.
      b. Flammable liquid/ solvent storage cabinets, which should use manufacturer's standard latch handles as required to satisfy requirements of regulatory approvals.
   2. All hardware shall be compliant with the ADA Standards for Accessible Design (28 CFR Part 36).

B. Drawer and Hinged Door Pulls:
   1. Drawer and door pulls shall attach to door or drawer with machine screws. Two (2) pulls shall be furnished on drawers wider than 28 inches (711 mm). Plastic pulls or other types subject to breakage are not acceptable.
   2. Type: Pulls shall be round "wire."
      a. Material and Finish:
         1). Stainless steel with finish as follows:
            a). BHMA 630 Satin (Previously US32D).
      b. Size:
         1). Length: 4 inches (100 mm) center to center of screw holes.
         2). Diameter: ¼ inch (6 mm).

C. Hinges:
   1. General: Hinges shall be attached to both door and case with three screws through each leaf. Provide two hinges for doors up to 48 inches (1219 mm) high; three hinges for doors over 48 inches (1219 mm) high.
   2. Type: Institutional with a five-knuckle bullet-type barrel. Characteristics:
      a. Height: 2½ inches (63 mm), nominal.
      b. Material: Stainless steel with stainless steel screws.
         1). Finish:
            a). BHMA 630 Satin (Previously US32D).
         2). Manufacturers:
            a). Rockford Process Control, Inc. 202 Seventh St., Rockford, IL 61104 Tel: 815 966-2000.
            b). Approved substitution/equal.

D. Shelf Hardware:
   1. Shelf Supports:
      a. Adjustable shelf supports: Adjustable clear plastic shelf support with lockdown clips.
   2. Manufacturers:
      a. Bainbridge Manufacturing, Inc., P. O. Box 487, 237 W 3rd, Waterville, WA 98858 Tel: 800 255-4702.
      b. The Engineered Products Company (Epco), P. O. Box 108, Flint, MI 48501 Tel: 313 767-2050.
      c. Knape & Vogt Manufacturing CO., 2700 Oak Industrial Dr. NE, Grand Rapids, MI 49505 Tel: 616 459-7620.
      d. Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746 Tel: 310 329-6373.
      e. Approved substitution/equal.

E. Catches:
   1. Roller Catches:
      a. Types and Materials: Roller catches shall be one of the following types. All-plastic or knuckle-type catches are not acceptable, except at corrosive storage cabinets.
         1). Tension ball catches consisting of a case with an adjustable-tension ball catch and a martching strike. Components shall be either stainless steel, chrome plated zinc alloy, or chrome-plated brass.
         2). Nylon roller housed in a steel case, which catches on a steel strike plate. Steel components shall be zinc finished.

3). At metal casework base cupboard, catches may consist of a two-piece heavy-duty cam action positive catch positioned near the pivoting edge of door which provides a clean unobstructed opening. Main body of the catch shall be confined within an integral cabinet divider rail, while latching post shall be mounted on the hinge side of door.
4). At corrosive storage cabinets, catches shall be non-metallic.

b. Application: Provide roller catches at ~~top of~~ all cabinet doors without elbow catches. ***ADD-2***
1). At wall cabinets locate roller catches at top of cabinet door.
2). At tall cabinets (other than skeleton cabinets) locate roller catches to fixed center shelf.
3). At skeleton cabinets locate roller catches at midpoint of door above handle. ***ADD-2***

c. Manufacturers:
1). The Engineered Products Company (Epco), P. O. Box 108, Flint, MI 48501 Tel: 313 767-2050.
2). Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746 Tel: 310 329-6373.
3). Approved substitution/equal.

2. Elbow catches: Heavy-duty, adjustable, spring-type elbow catch and strike plate.
a. Material: Brass or steel with bright chromium plated finish.
b. Application: Elbow catches shall be used on left hand doors of locked double door cabinets, including tall cabinets.
1). At tall cabinets, elbow catch shall latch to fixed center shelf. Latching devices using chains or strings are not acceptable.
c. Manufacturers:
1). The Engineered Products Company (Epco), P. O. Box 108, Flint, MI 48501 Tel: 313 767-2050.
2). Approved substitution/equal.

F. Drawer slides:
1. Typical: Ball bearing slides:
a. Material:
1). Clear, zinc-coated steel.
b. Full extension, 100 lb/pr. (45 kg/pr.) capacity: Accuride 3832, Fulterer FR5000, or equal.
c. File drawers and other drawers noted as having heavy duty slides shall be equipped with rail mounted with overtravel, 150 lb/pr. (68 kg/pr.) capacity: Accuride 4034, Fulterer 5755, or equal.
d. Manufacturers:
1). Accuride, 12311 Shoemaker Ave., Santa Fe Springs, CA 90670 Tel: 562 903-0200.
2). Hettich America LLP, 6225 Shiloh Road, Alpharetta, Georgia 30005 Tel: 770 887-3733.
3). Fulterer USA, 542 Townsend Ave., High Point, NC 27263 Tel: 800 395-4646.
4). Waterloo Furniture Components Inc., 501 Manitou Dr., Kitchener, Ontario, Canada N2C 1L2 Tel: 519 748-5060.
5). Approved substitution/equal.

G. Drawer Stops: All regular drawers shall be equipped with integral stops to prevent drawer head impact with cabinet body.

H. Door Stops: Provide door stops for any cabinet door, which will strike an obstruction when opened between 90° and 135°.
1. Stop to be either:
a. Sash chain, #30 zinc-plated steel.
1). Terminations: Zinc chromate wire screw eyes. Open eye as required to attach stop with screws. Through-bolting not allowed.
b. Coated cable.
1). Seven-strand, 7-wire-per-strand, stainless steel cable with clear nylon coating.
2). Wire diameter: 0.047 inches.
3). Composite diameter with coating: 0.063 inches.
4). Terminations: Number 10 stake eye on both ends. Attach to door/cabinet with screws. Through-bolting not allowed.
5). McMaster Carr part number 30345T3 or equivalent.
2. Engineer stop to length to allow door to open 1 ½ inch (40 mm) from obstruction.

I. Hanging File Suspension System: Hangers shall be fastened and secured to drawer construction and shall not be freestanding units set inside the drawer. Provide in all file drawers.
   1. Basis of Design: Blum Metafile Hanging File Frame Kit.
   2. Manufacturers:
      a. Julius Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164 Tel: 800 438-6788.
      b. Hettich America L. P., 6225 Shiloh Rd., Alparetta, GA 30005 Tel: 800 438-8424.
      c. Approved substitution/equal.

J. Label holders: Provide label holders, pinned in place. Stick-on holders not acceptable. Label holders shall be provided at all file drawers, and elsewhere as shown on drawings.
   1. Size:
      a. Minimum Size: 1 inch (25mm) x 2 inches (50mm)
      b. Maximum Size: 2 inches (50mm) x 3 ½ inches (90mm)
   2. Material and finish:
      a. Steel with matt chrome finish.
   3. Basis of Design Product:
      a. 704ANO Label Holder by Knape & Voght, 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505 Tel: 800 253-1561.
      b. Approved substitution/equal.

K. Number Plates: Provide 5/8 inch (16 mm) x 1 ¼ inches (32 mm) aluminum number plates with black numbers, pinned in place. Stick-on holders not acceptable. Number plates shall be provided at all drawers where indicated on the plans. Number drawers sequentially in each laboratory as directed by Architect and Owner.

L. Locks:
   1. General: Provide locks on all file cabinet drawers. Provide locks at other locations as indicated on the drawings.
   2. Lock type: Deadbolt-type lock.
      a. Disc-tumbler-type locks and/or cam-type locks will not be accepted.
      b. Framed sliding door locks shall be plunger type.
      c. Refer to Elbow Catches section, above, for requirements at two-swinging-door cabinets.
   3. Testing requirements:
      a. Locks shall comply with ANSI/BHMA standard E07121.
      b. Lock shall be cycle tested per ANSI/BHMA A156.11 Grade 1.
   4. Include spacers, adapters, fasteners, and strikes.
      a. All locks shall strike into metal material. Striking directly into wood is not acceptable.
   5. Barrel length shall be coordinated with specific conditions.
   6. Finish: Locks shall have satin nickel or satin chrome finish.
   7. Coordinate with Laboratory Furnishings plans.
   8. Keying:
      a. Key quantities: Provide two keys per lock. Provide four copies of any master/ grand master keys.
      b. Key system:
         1). Key system shall support a minimum of 2000 different keys.
         2). Key system shall support up to three levels of master keys (grand-master keys, master keys, and sub-master keys) in addition to individual keys.
      c. Key cylinder type:
         1). Coordinate key type with owner.
      d. Key schedule: Coordinate key schedule with Owner.
   9. Key engraving:
      a. Keys to be engraved with an identification number corresponding to the layout of unique keys on the project. All identical keys shall be engraved with the same number.
      b. At laboratories with multiple, individually-locked drawers where number plates are indicated, engrave each key with number to match the number plate on each drawer.
   10. Manufacturers:
      a. Swinging Doors and Drawers:
         1). Illinois Lock Company, 301 West Hintz Rd., Wheeling, IL 60090 Tel: 847 537-1800.
         2). National Cabinet Lock, 200 Old Mill Rd., P. O. Box 200, Mauldin, South Carolina 29662 Tel: 864-297-6655.

3). Olympus Lock, Inc. 18424 Highway 99, Lynnwood, Washington 98037 Tel: 206 362-3290.
4). Approved substitution/equal.

M. Fixed Padlock Eye
1. Stainless-steel fixed padlock-eye and strike plate at cabinet locations as indicated on the drawings. Strike plate, or protection plate, shall be large enough to prevent padlock from damaging door or drawer front.
2. Rotating cam-type padlock hasps are not acceptable and shall not be provided.

N. Glides: Non-marring material, 1 inch (25 mm) diameter, minimum, with at least 5/8 (16 mm) vertical adjustment. Provide on movable tables, unless otherwise indicated.

O. Leveling devices: Provide each table leg with 3/8 inch (10 mm) minimum diameter leveling bolt and floor clip.

P. Leg shoes: Leg shoes shall be provided on all legs and table legs to conceal leveling devices, except for tables with casters. Shoes shall be 2 ½ (63 mm) inch high and of black rubber or pliable black vinyl material. Use of a leg shoe which does not conceal leveling device is not acceptable.

Q. Floor clips: Provide leg assemblies and fixed table legs with floor clips securely fastened to the floor after shimming.

R. Casters: Where indicated on Laboratory Furnishing drawings, provide sets of 3 ½ inch (89 mm) diameter wheels with self-lubricating bearing, rated to carry 250 pounds (113 kg) minimum each. Each caster must swivel and have a locking brake. Wheel shall be of molded polyurethane tread mechanically locked to a polyolefin core.
1. Material: Caster shall be heavy gauge cold rolled steel with bright zinc plating.

S. Support Struts and Service Ledging: Refer to specifications for slotted channel framing in this Section.

2.4 ZOOLOGY AND ORNITHOLOGY SPECIMEN CABINETS

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
1. Lane Science Equipment Corporation, 225 West 34th Street, New York, NY 10122 Tel: 212 563 0663.
2. Viking Metal Cabinet Co., 5321 West 65th Street, Chicago, IL 60638 Tel: 800 776 7767.
3. Delta Design Ltd., P. O. Box 1733, Topeka KS 66601 Tel: 785 234-2244.
4. Approved substitution/equal.

B. Basis of Design: Lane Model 201 stackable zoology and ornithology specimen cabinet, or equal.

C. Size: 46 1/2 inches wide x 28 1/32 inches deep x 42 1/16 inches tall.

D. Cabinet: Single compartment with double wall construction, two lift off double-paneled doors with elastomeric door seals and fumigant compartments, and guides for a maximum of 9 high rim storage trays or 18 low rim storage trays.

E. Trays:
1. Where indicated, provide 9 high rim masonite/aluminum trays, model 201-T, 3 ½ inches high x 42 3/8 inches wide x 26 inches deep.
2. Where indicated, provide 9 high rim powder coated steel trays, model 201-T/S, 3 ½ inches high x 42 3/8 inches wide x 26 inches deep.

F. Provide seismic anchorage suitable for cabinets stacked in configuration shown.

2.5 MAP STORAGE FILE

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
1. Mayline Company, Inc., 619 N. Commerce, P.O. Box 728, Sheboygan, WI 53082 Tel: 414 457-5537.
2. Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121.

3. Viking Metal Cabinet Co., 5321 West 65th Street, Chicago, IL 60638 Tel: 800 776-7767.
4. Approved substitution/equal.

B. Basis of Design: Stackable, interlocking steel plan files with coated fabric dust covers in each drawer for storing maps up to 24 inches x 36 inches as follows:
1. Flush base: Mayline 7767-W, or equal.
2. Five drawer units: Mayline 7767-D, or equal.
3. Steel cap: Mayline 7767-U, or equal.

2.6 LABORATORY WORK SURFACES

A. Epoxy Resin:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   a. Durcon Laboratory Tops, Inc., 206 Allison Drive, Taylor, TX 76574 Tel: 512-595-8000.
   b. Epoxyn Products, 500 E. 16th Street, Mountain Home, AR 72653 Tel: 870 425-4321.
   c. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202.
   d. Prime Industries, Inc., 2600 Warrenville Road, Suite 205, Downers Grove, IL 60515 Tel 630-725-9200
   e. Approved substitution/equal.
2. Thickness:
   a. Typical work surface: 1 inch (25 mm).
   b. Fume hood work surfaces: Tops shall be 1¼ (32 mm) inches thick at outer edge, indented minimum ¼ inch (6 mm) to provide a raised rim around all exposed edges 1 inch (25 mm) wide, minimum, or as to allow for the fume hood sash. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded or chamfered to a 1/8 inch (3 mm) radius. The juncture between the raised rim and the top surface shall be coved or chamfered to a ¼ inch (6 mm) radius.
   c. Curbs and Splashes: ¾ inch (19 mm).
3. Color:
   a. Black.
   b. Color sample to be approved by Architect before work is put in hand.
4. Description:
   a. Monolithic filled epoxy resin work surface consisting of a polymerized cast resin material oven-cured in molds.
   b. Drip Grooves: Provide under all work surface exposed edges, unless noted otherwise on the Laboratory Furnishing Drawings. Drip grooves shall be ½ inch (13 mm) from the front edge where the top overhangs 1 inch (25 mm) and ¼ inch (6 mm) from the edge where the edge overhangs ½ inch (13 mm).
   c. Edge profile: For all exposed upper edges and corners:
      1). Bevel eased: 1/8 inch (3 mm) machined bevel with blended radius corners.
   d. Marine edges: Where indicated on the Laboratory Furnishing Drawings, shall be 1 inch (25 mm) wide and ¼ inch (6 mm) high with chamfered or radiused transition to and be an integral part of the work surface.
   e. Sink Mounting:
      1). Drop-in Sink Cutouts: Cutouts shall be profiled to provide support for the sink, and to ensure that the rim of the installed sink is 1/8 inch (3 mm) below the surrounding work surface level or bottom of drain grooves, if present. The top edge of the cutout shall have 1/8 inch (3 mm) bevel. Ensure that there shall be no gaps between the installed sink rim and work surface.
   f. Curbs and Splashes:
      1). Height: 4 inches (100 mm), unless noted otherwise on Laboratory Furnishing Drawings.
      2). Bonded to the surface of the top to form a square joint.
   g. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Verify size of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 inch (3 mm). After sawing, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a waterproofing material recommended by the manufacturer.

h. Provide full-length, one-piece tops and backsplashes wherever possible, and keep field joints to an absolute minimum.

5. Physical Properties:
   a. Chemical resistance:
      1). Organic solvents: A cotton ball, saturated with the test chemical, is placed in a one ounce bottle with a reservoir of liquid above the ball. The container is inverted on the test material surface for a period of 24 hours. Test temperature: 23°C ±2°C.
      2). Other test chemicals: Five drops (1/4 cc) of the test chemical are placed on the test material surface. The chemical is covered with a 1 inch diameter watch glass for a period of 24 hours. Test temperature: 23°C ±2°C.
      3). Evaluation: After 24 hours exposure, exposed areas are washed with water, then a detergent solution, finally with naphtha, then rinsed with distilled water, dried with a cloth, and rated as follows:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

      4). Test results:

Test chemical	Concentration	Black	Dark gray	Light gray	Beige
Chromic acid	40%	3	2	2	2
Hydrochloric acid	10%	0	0	0	0
Hydrochloric acid (conc.)	37%	0	0	0	0
Nitric acid	40%	0	0	0	0
Nitric acid (conc.)	70%	0	0	0	0
Sulfuric acid	60%	0	0	0	0
Sulfuric acid (conc.)	96%	4	4	4	4
Acetic acid	5%	0	0	0	0
Acetic acid (glacial)		0	0	0	0
Citric acid	1%	0	0	0	0
Oleic acid		0	0	0	0
Phenol solution	5%	0	0	0	0
Ammonium hydroxide	10%	0	0	0	0
Sodium carbonate sol.	20%	0	0	0	0
Sodium hydroxide sol.	60%	0	0	0	0
Sodium hypochlorite sol.	4%	0	0	0	0
Acetone		1	1	1	1
Benzene		1	1	1	1
Carbon tetrachloride		1	1	0	0
Diethyl ether		0	0	1	1
Dimethyl formamide		0	0	0	0
Ethyl acetate		0	1	1	0
Ethyl alcohol	95%	0	0	0	0
Ethylene dichloride		0	0	0	0

Test chemical	Concentration	Black	Dark gray	Light gray	Beige
Heptane		0	0	1	0
Isooctane		0	0	0	0
Kerosene		0	0	0	0
Methyl alcohol		0	0	0	0
Toluene		0	0	0	0
Aniline		0	0	0	0
Mineral oil		0	0	0	0
Olive oil		0	0	0	0
Soap solution	1%	0	0	0	0
Transformer oil		0	0	0	0
Turpentine		0	0	0	0

b. Heat resistance:
   1). High temperature test: A porcelain crucible is heated to a dull red color, placed on the test material, and allowed to cool to ambient temperature. Result: No observable surface deformation.
   2). Flame test: A 3/8 inch (10 mm) Bunsen burner is adjusted to a quiet flame with a 1½ inch (38 mm) inner cone, overturned on the test material, and allowed to stay for 5 minutes. Result: no observable surface deformation.

c. Physical properties:

Compressive strength	ASTM D695	31,400 psi (216 MPa)
Tensile strength	ASTM D638	8,000 psi (55 MPa)
Flexural strength	ASTM D790	11,700 psi (81 MPa)
Rockwell hardness “M”	ASTM D785	105-110
Specific density	ASTM D792	122.4 lb/ft^3 (1960 kg/m^3)
Water absorption	ASTM D570	0.01%
Fire Resistance	ASTM D635	ATB (sec)=0
Heat deflection @ 264 psi (1.82 MPa)	ASTM D648	205°F (172°C)

B. Stainless Steel: Refer to Stainless Steel Fabrications section of this specification.

2.7 DOWNDRAFT DISSECTION TABLE WITH HINGED COVER

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
   1. Mopec, 21750 Coolidge Highway, Oak Park, MI 48237 Tel: 800 362-8491.
   2. Thermo Shandon, 171 Industry Drive, Pittsburgh, PA Tel: 800 547-7429.
   3. Mortech Manufacturing Company, 45 La Porte St., Arcadia, CA Tel: 800 410-0100.
   4. Jewett, 275 Aiken Rd., Asheville, NC 28804 Tel: 800 879-7767.
   5. Approved substitution/equal.

B. Basis of Design: Mopec Model HB450-MOD (modified) as specified herein, or equal.

C. Description: Downdraft dissecting table for dissection of cadavers.

D. Product Characteristics:
   1. All 14 gauge (2.0 mm) stainless steel construction, with a #4 satin finish. Sub-frame shall be 12 gauge (2.8 mm) stainless steel.
   2. All inside and outside corners and edges rounded for easy cleaning. Heliarc welded seams and joints, ground and polished to a smooth finish.
   3. Four 1-1/2 inch (38 mm), minimum, tubular legs with adequate cross support. Legs to be manual adjustable height with hand crank operation adjustable from a maximum of 30 inches above finish

floor to a minimum of 36 inches above finished floor. Legs rest on 5 inch (125 mm) diameter casters with swivel locks and wheel brakes.

4. Stainless steel hinged hood, continuously welded, with corner reinforcing strap. Provide continuous stainless steel hinges. Provide latches to lock hood covers open below the table during use and to lock hood close when not in use.
5. Table shall drain toward one end. Drain outlet shall have PVC stop valve. Table shall have means of suspending a drain pail below the drain outlet and stop valve.
6. Work surface shall have perimeter perforations to a plenum below the table. The plenum shall be designed for even airflow and terminate in a single 6 inch (150 mm) diameter duct collar.
7. Clear, 6 inch (150 mm) diameter PVC hose shall be attached to plenum duct collar and shall be attached to exhaust system duct provided by Division 23.
   a. Hose shall be reinforced with white vinyl-covered spring steel wire helix.
   b. Hose shall be abrasion, moisture, corrosion, chemical, and weather-resistant.
   c. Hose wall shall be 0.05 inches (1.3 mm) thick.
   d. Hose shall be UL recognized for flame resistance to UL 94-VO.
   e. Provide metal hose clamp, Mopec “Q-F” or equal, with resilient seal. Provide chain through clamp handle to table leg to prevent loss of hose clamp.
8. Dimensions: 80 inches long x 30 inches wide x 36 inches high (2000 mm x 760 mm x 915 mm high) (to table top).

2.8 SHELVING ASSEMBLIES

A. High-Pressure Decorative (Plastic) Laminate Shelving:

1. Manufacturers/Facing material: Products complying with this specification may be provided by the following manufacturers.
   a. Nevamar Decorative Surfaces, One Nevamar Place, Hampton, SC 29924 Tel: 800 638-4380.
   b. Pionite Decorative Surfaces, One Pionite Road, P.O. Box 1014, Aubern, ME 04211 Tel: 800 746-6483.
   c. Wilsonart International, 2400 Wilson Place, P. O. Box 6110, Temple, TX 76503 Tel: 800 433-3222.
   d. Approved substitution (no known equal).
2. Approved Products:
   a. Nevamar ChemArmor.
   b. Pionite ChemGuard.
   c. Wilsonart ChemSurf
3. Color: To be selected by Architect.
4. Description:
   a. High-pressure decorative laminate, meeting or exceeding NEMA Standard LD3 2005 Grade HGP, HGL, or HGS requirements, consisting of a resin formulation applied over the decorative surface paper to achieve chemical resistance. The decorative paper shall be treated with melamine resin, and the core shall consist of kraft papers impregnated with phenolic resin. Sheets shall be bonded under high temperature and pressure. Product shall be developed for casework, work surface, and shelving surfaces in laboratories.
   b. Laminate shall be applied to top and bottom surfaces.
   c. Finish: Fine pebble-grained “crystal” texture or matte texture with slight sheen to minimize smudges and finger marks, and to provide optimum scratch resistance.
      1). Gloss: 15-16 +/- 3 gloss units.
   d. Physical Properties:
      1). Reference Standard: Plastic laminates shall meet or exceed ANSI/NEMA Specification LD3-2005 as specified herein.
      2). Minimum Thickness: 0.038 inches ± 0.005 inches (0.97 mm ± 0.13 mm).
      3). Cleanability: 10 cycles (NEMA LD3 test method 3.4).
      4). Boiling Water Resistance: No effect (NEMA LD3 test method 3.5).
      5). High Temperature Resistance: Slight effect (NEMA LD3 test method 3.6).
      6). Scratch Resistance: 4.5 Newtons (NEMA LD3 test method 3.7).
      7). Ball Impact Resistance: 60 inches (1524 mm) (NEMA LD3 test method 3.8).
      8). Radiant Heat Resistance: 200 sec (NEMA LD3 test method 3.10).
      9). Dimensional change:
      10). Machine direction: 0.50% (NEMA LD3 test method 3.11).

11). Cross direction: 0.80% (NEMA LD3 test method 3.11).
12). Wear resistance: 1,500 cycles, min. (black); 700 cycles, min. (other colors) (NEMA LD3 test method 3.13).
13). Blister Resistance: 70 sec (NEMA LD3 test method 3.15).
14). Stain Resistance Performance Test Results: The surface shall show essentially no effect on Black (Lab grade) plastic laminate when left in contact for 16 hours either when reagents were kept covered or allowed to evaporate.

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

Acids	Concentration	Rating
Acetic acid	All	0
Aqua regia		0
Chromic trioxide (Chromic acid cleaning solution)		1
Glacial acetic acid	99%	0
Hydrochloric acid	All	0
Hydrofluoric acid	48%	0
Formic acid	All	0
Nitric acid	All	3
Sulfuric acid	All	0
Perchloric acid (concentrated)		0
Phosphoric acid	All	0
Picric acid	1.2%	0
Tannic acid (saturated)		0
Uric acid (saturated)		0

Alkalis		
Ammonium hydroxide	All	0
Sodium hydroxide	All	3
Sodium sulfide	15%	0

Solvents		
Acetone		0
Amyl acetate		0
Amyl alcohol		0
Butyl alcohol		0
Carbon disulfide		0
Carbon tetrachloride		0
Chlorobenzene		0

Solvents		
Chloroform		0
Cresol		0
Dimethylformamide		0
Dioxane		0
EDTA		0
Ethyl acetate		0
Ethyl alcohol		0
Formaldehyde		0
Methanol		0
Methyl ethyl ketone		0
Methylene chloride		0
n-Hexane		0
Naphthalene		0
Phenol		0
Tetrahydrofuran		0
Toluene		0
Trichlorethane		0
Xylene		0

General Reagents		
Alconox (lab detergent)		0
Aluminon		0
Ammonium phosphate		0
Aromatic ammonia		0
Benedicts solution		0
Calcium hypochlorite (concentrated)		0
Camphorated parachlorophenol		1
Cellosolve		0
Copper sulfate		0
Ethylene glycol		0
Eucalyptol		0
Formalin		0
Gasoline		0
Hydrogen peroxide	3%	0
Iodine		0
Karl Fisher Reagent		0
Kerosene		0
Lactated ringers		0
Lysol		0
Methyl methacrylate		0
Mineral Oil		0
Monsel’s solution (Ferric subsulfate)		0
Naphtha		0
Petroleum jelly		0
Phosphate buffered saline (PBS)		0
Pine oil		0
Potassium permanganate		0
Povidone iodine		0
Procaine		0
Quaternary ammonia compounds		0
Silver nitrate		0
Sodium azide		0
Sodium chromate		0
Sodium hypochlorite	5%	0
Sodium thiocyanate		0
Sucrose	50%	0
Thymol & Alcohol		0

General Reagents		
Tincture of Iodine		0
Tincture of Mercurochrome		0
Tincture of Merthiolate		0
Trisodium phosphate	30%	0
Urea		0
Vegetable oils		0
Water		0
Zephiran chloride		0
Zinc chloride		0
Zinc oxide ointment		0

Stains and Indicators		
Ag Eosin Bluish 5% in Alcohol		0
Bromothymol Blue		0
Cresol Red		0
Crystal Violet		0
Gentian Violet	1%	0
Gram Stains		0
Malachite Green		0
Methyl Orange		0
Methyl Red		0
Methylene Blue		0
Nigrosine		0
Safranin O		0
Sudan III		0
Thymol Blue		0
Wright's Blood Stain		0

5. Plastic laminate adhesive: High-pressure decorative laminate shall be bonded to core with thermosetting resorcinol or phenol-resorcinol adhesive, or as recommended by the manufacturer for the application, at temperature above 65°F (18.3°C) at a pressure no less than 15 pounds per square inch. Laminate core is not to exceed 10% moisture content and is to be laminated and cured in a controlled environment between 45% and 60% RH.
6. Core material: Hardwood Veneer Plywood.
   a. Description: A one step calibrated core +/- .5mm (to avoid voids) with type 1 waterproof nauf glue. Grade 2 face, and back of mill choice plywood veneer.
   b. Thickness/Plies:
      1). 1 inch (25 mm): minimum 9-ply.
   c. Physical Properties:
      1). Average modulus of rupture: 7346 psi (50.65 N/mm^2).
      2). Face Screw Holding Strength: 355 lbf (1579 N).
7. Edging:
   a. Unless otherwise indicated, all edges shall be edgebanded with 3 mm PVC edge banding set in hot melt adhesive. Adhesive shall have a minimum softening point of 150°F (65.6°C). Apply primer to substrate when recommended by adhesive manufacturer. Contact cement is not acceptable. Color of edgebanding to be selected by the Architect.
   b. Safety Edges:
      1). Types:
         a). Retainer Rail: ¼ inch (6 mm) diameter stainless steel retainer rail, as indicated on the drawings.
      2). Refer to the description of each system below for locations of each type.

B. Reagent Shelves with Fixed Tubular Supports.
   1. Shelving: High-Pressure Decorative Laminate shelving as specified above.
   2. Shelf supports shall be Type 304 stainless steel tubing, ASTM A312, 1 inch (25 mm) outside diameter, 0.133 inch (3.4 mm) wall thickness, with ¼ inch (6 mm) thick welded steel threaded inserts as shown on drawings.
   3. Fasteners shall be slotted, flat head, zinc screws with bolts as shown on drawings.
   4. Safety edging:

a. Provide safety edging at all four edges of overall installation. Do not provide safety edging at intermediate butt joints.
b. Retainer rail.

5. Load capacity: System shall support a minimum of 25 pounds per square foot. Maximum deflection shall be 0.35 inches (9mm) under load.

C. Reagent Shelves on adjustable shelf standards with a steel tube support system.

1. Shelving: High-Pressure Decorative Laminate shelving as specified above.
2. Steel Frame Support System: Provide cold rolled steel tube vertical and horizontal support members with radiused edges. All members shall be welded together. Grind all welds smooth and polish to produce clean smooth appearance with no visual evidence of welds after paint is applied. All vertical members shall be one piece continuous from floor to underside of structure above or to top horizontal member as indicated on the drawings. Horizontal top and intermediate members shall be one piece between vertical members. Provide welded caps at all open ends of tube sections. Secure vertical members to floor slab, underside of benchtop, if indicated on the drawings, and to underside of structure above.
   a. Tube steel dimensions:
      1). 2 inches x 2 inches, 12 gauge (50 x 50 x 2.8 mm).
3. Shelf standards:
   a. Steel tubes shall be punched to receive adjustable shelf brackets. Pattern shall match Knape & Vogt 85 ANO series uprights, length in accordance with drawings.
4. Shelf Brackets: 16 gauge (1.6 mm thick) bookend type, as detailed on drawings.
5. Safety edging:
   a. Front Edge:
      1). Retainer rail.
   b. Rear edge:
      1). Retainer rail.
6. Load capacity: System shall support a minimum of 35 pounds per square foot applied at all shelves simultaneously. Maximum deflection shall be 0.35 inches (9mm) under load.
7. Finish: Factory-finish steel tube support system, shelf standards, and brackets with epoxy powder coating. Color to be selected by the Architect.

D. Adjustable Wall Shelves:

1. Shelving: High-Pressure Decorative Laminate shelving as specified above.
2. Double Slot Shelf Standards:
   a. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
      1). Knape & Vogt Manufacturing Company, 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505 Tel: 616 459-3311.
      2). Approved substitution.
   b. Basis of Design: Knape & Vogt 85 ANO series uprights, or equal. Length as indicated on the drawings.
3. Shelf Brackets: 16 gauge (1.6 mm) bookend type, as detailed on drawings.
4. Safety edging:
   a. Front Edge:
      1). Retainer rail.
5. Load capacity: System shall support a minimum of 35 pounds per square foot applied at all shelves simultaneously. Maximum deflection shall be 0.35 inches (9mm) under load.
6. Finish: Factory finish standards and brackets with epoxy powder coating. Color to be selected by the Architect.

E. Heavy Duty Wall Shelves:

1. Shelving: High-Pressure Decorative Laminate shelving as specified above. All shelves to be one piece continuous full length of assembly.
2. Heavy duty shelf standards: Slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.
3. Heavy duty shelf brackets:
   a. Shelf Brackets: Cold-formed steel, slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.

4. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.
5. Safety edging, provide at all four edges of each shelf or as indicated:
   a. Retainer rail.
6. Load capacity: System shall support a minimum of 50 pounds per square foot applied at all shelves simultaneously. Maximum deflection shall be 0.35 inches (9mm) under load.

F. Stainless Steel Shelving System

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
   a. InterMetro Industries Corporation, 651 North Washington St., Wilkes-Barre, PA 18705 Tel: 800 992-1776. Manufacturer of Metro product range.
   b. Eagle Group, 100 Industrial Blvd., Clayton, DE 19938 Tel: 302 653-3000.
   c. Nexel Industries Inc., March Equipment Inc., US Highway 206, Box 18, Flanders, NJ 07836 Tel: 973 584-4269.
   d. Approved substitution/equal.
2. Floor Mounted Stainless Steel Shelving Systems
   a. Basis of Design: Metro Super-Erecta stainless steel shelf system, floor mounted post supported, or equivalent.
   b. Posts: floor mounted stainless steel posts, grooved at 1 inch (25 mm) increments and numbered at 2 inch (50 mm) increments for shelf adjustment, length as shown on drawings, Metro PS series or equal.
   c. Shelves:
      1). Open Wire: stainless steel wire.
   d. Provide diagonal bracing for lateral stability at freestanding applications.
   e. Accessories:
      1). Foot Plate: stainless steel with adjustable leveling bolt, Metro No. 9993S or equal.
      2). Post Clamps: Zinc-plated, to join adjacent posts, Metro No. 9994Z or equal.
      3). Shelf Ledges:
         a). 1 inch (25 mm) high stainless steel wire, Metro No. LxxN-1S or equal, sized to match shelf.

2.9 CYLINDER RACKS AND RESTRAINT ASSEMBLIES

A. Cylinder Restraint Assembly:

1. Framing channel, Fittings, Swivel Hangers, and End Caps: Slotted channel framing as specified elsewhere on this Section.
2. Provide two swivel hangers per cylinder or dewar per wall bracket
3. Sizing:
   a. Size typical units to accomodate standard-size laboratory gas cylinders.
   b. Where shown on drawings, size units to accomodate liquefied gas dewars.
4. Chain: Provide restrainers of 5/16 inch diameter, Type 304 stainless steel welded chain fitted with stainless steel snap shackle with swivel clevis and split ring for each bracket; McMaster-Carr Supply Company, Suncor Marine & Industrial, Inc., or approved substitution.
5. Cylinder restraint steel components shall be factory-finished to match the casework metal color as selected for the project.

2.10 OVERHEAD SERVICE CARRIERS

A. Materials:

1. Support Framing: Slotted channel framing as specified elsewhere on this Section.
2. Brake-formed metal: 16 gauge (1.6 mm) galvanized steel with epoxy powder-coated finish.

B. Fabrication: Fabricate and assemble components as detailed on the drawings.

C. Coordination: Carefully coordinate location of supports with the work of other Sections.

D. Finish: As specified for slotted channel framing. Color shall be selected by the Architect.

2.11 OVERHEAD SUPPORT GRID (OVERHEAD UNISTRUT)

A. Product Characteristics: Suspended channel grid, designed to support 200 lb. (0.89 kN) point load at any position and 50 lb./sq. ft. (0.73 kN/m) uniformly distributed load. All brackets, channels, etc. shall be provided for a complete installation.

B. Materials: Slotted channel framing as specified elsewhere on this Section.

C. Fabrication: Fabricate and assemble components as detailed on the drawings.

D. Coordination: Carefully coordinate location of supports with the work of other Sections.

2.12 PIPE DROP ENCLOSURE

A. Fabricate pipe drop enclosures from minimum 18 gauge (1.3 mm thick) cold rolled steel, per details shown on the Laboratory Furnishing drawings, except as noted.
   1. Pipe drop enclosures at the following locations shall be fabricated of 18 gauge, Type 304 stainless steel with a #4 finish:
      a. At scullery sinks.
      b. At stainless steel counters.

B. Seal all joints between dissimilar metals and at all panel seams with clear silicone sealant.

C. Materials and finish shall be as specified under Metals Fabrications in this Section.

2.13 DRYING RACK

A. Stainless Steel Drying Rack with White Polypropylene Pegs:
   1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
      a. Inter Dyne Systems, Inc., 676 Ellis Road, Norton Shores, MI 49441 Tel: 231 799-8760.
      b. Approved substitution (no known equal).
   2. Basis of Design: Inter Dyne Systems “V” Victoria Series, modified as indicated on the drawings.
      a. Drying rack bodies shall be of one-piece design and of not less than 20 gauge (1.0 mm thick) Type 304 stainless steel with a No. 4 finish. The top shall have two 90-degree bends, and sides to have one 90 degree bend.
      b. Each rack shall have an integral full-width 20 gauge (1.0 mm thick), Type 304 stainless steel drip trough with stainless steel drain tube. Drip trough shall be continuously welded.
      c. The trough shall have a full-length, Type 304 stainless steel wire mesh screen insert. Screen insert shall be turned down on all four sides to provide a clean and finished appearance.
      d. Each rack front shall be dimensioned and punched with T-shaped holes to accommodate the peg arrangement shown on the drawings.
   3. Pegs shall fit into the punched holes in the rack front. A T-shaped protrusion on the base of the pegs shall allow easy removal and replacement without the need for tools. The T-shaped holes shall be designed to fit the protrusion on support pegs for holding single or multiple utensil drip trays, drain shelves, funnel racks or pipette holders. Pegs shall be of injection-molded white polypropylene.
   4. Provide wall hangers for each rack, designed to enable the removal and replacement of the entire rack for cleaning without the need for tools.
   5. Provide stainless steel fixing screws of appropriate type for attachment to support structure.
   6. Provide clear, tight-fitting hose to drain from drip trough drain tube into sink.
   7. Provide finished stainless steel back panel when any portion of the back of drying rack is exposed.

2.14 ACCESSORIES

A. Utility Management Hook
   1. Type 303 stainless steel hook with polished finish.
   2. Size: 4 23/32 inch tall, 2 43/64 inch wide.
   3. Load capacity: 22 pounds.
   4. Basis of Design Model: McMaster-Carr Model No. 19075A12.

5. Manufacturer: McMaster Carr, P.O. Box 54960, Los Angeles, CA 90054-0960 Tel: (562) 692-5911, or approved equal.

B. Grilles
1. Air intake grilles: Perforated metal mesh in a metal frame.
2. Sizes: As shown on drawings.
3. Mesh Pattern: Mesh 1.
4. Color: Factory-applied light grey paint.
5. Basis of Design Model: Doug Mockett & Co., Inc. GT Series Grilles.
6. Manufacturer: Doug Mockett & Co., Inc. P.O. Box 3333, Manhattan Beach, CA 90266 Tel 800 523-1269 or approved equal.

2.15 FINISH FOR MISCELLANEOUS WOOD ITEMS

A. Applicability: This section applies to wood fabrications, including, but not limited to, wood laboratory tables and wood filler panels.

B. Finish:
1. Manufacturer may uses either of the following finish systems:
a. Customized, high-solids, cross-linked, ultraviolet light (UV)-cured coating developed for durability, including abrasion, chemical, impact, and scratch resistance, for flat-line applications. Coatings shall have little or no VOCs. Chemical-resistant modified acrylic urethane finish with built-in UV blocker, or equal, applied over permanent wood stain.
2. Stain Color:
a. Base Bid: To be selected by Architect from manufacturer's full published color range. ***ADD-2***
b. Alternate Bid: Clear finish. Refer to Section 012300 for additional information. ***ADD-2***
3. Application:
a. Finish application and sequence shall be as recommended and designed by the manufacturer for a high quality, laboratory-grade wood casework finish.
b. Preparation: Sand exposed surfaces smooth, free from dirt and defects.
c. Stain application: Apply stain of color selected to all exposed casework surfaces. Apply in a manner to achieve a match with the selected color sample upon completion of application of the finish.
d. Finish application: Apply top finish to all stained surfaces. Finished surfaces shall be even, water-clear and bright. Cloudy or muddy finishes carrying tinting pigments will not be acceptable.
e. Stain Color:
1). Base Bid: To be selected by Architect from manufacturer's full published color range. ***ADD-2***
2). Alternate Bid: Clear finish. Refer to Section 012300 for additional information. ***ADD-2***

C. Wood Finish Chemical Resistance Performance Requirements:
1. Manufacturer shall submit wood finish chemical resistance performance test results. Testing to be performed by independent testing agency.
2. Procedure: Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods. For both methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM.
a. Method A: Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.
b. Method B: Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, concave side down.
3. Rating System: Evaluations shall use the following rating system:

Level 0	No detectable change.
Level 1	Slight change in color or gloss.
Level 2	Slight surface etching or severe staining.

Level 3	Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

4. Acceptance Level:
   a. Individual test results for the specified 49 reagents shall be within the Range for that reagent as specified on the table below.
   b. There shall be no more than four (4) Level 3 conditions.
5. Table of reagents:

Test No.	Chemical Reagent	Test Method	Range
1.	Acetate, Amyl	A	0-1
2.	Acetate, Ethyl	A	0-1
3.	Acetic Acid, 98%	B	0-1
4.	Acetone	A	0
5.	Acid Dichromate, 5%	B	0-1
6.	Alcohol, Butyl	A	0-1
7.	Alcohol, Ethyl	A	0
8.	Alcohol, Methyl	A	0-1
9.	Ammonium Hydroxide, 28%	B	0-2
10.	Benzene	A	0-1
11.	Carbon Tetrachloride	A	0-1
12.	Chloroform	A	0
13.	Chromic Acid, 60%	B	0-1
14.	Cresol	A	0-2
15.	Dichloroacetic Acid	A	0-3
16.	Dimethylformamide	A	0-2
17.	Dioxane	A	0-1
18.	Ethyl Ether	A	0-1
19.	Formaldehyde, 37%	A	0
20.	Formic Acid, 90%	B	0-1
21.	Furfural	A	0-1
22.	Gasoline	A	0
23.	Hydrofluoric Acid, 37%	B	0-2
24.	Hydrofluoric Acid, 48%	B	0-2
25.	Hydrogen Peroxide, 30%	B	0-1
26.	Iodine, Tincture of	B	0-2
27.	Methyl Ethyl Ketone	A	0
28.	Methylene Chloride	A	0-1
29.	Monochlorobenzene	A	0-1
30.	Naphthalene	A	0
31.	Nitric Acid, 20%	B	0
32.	Nitric Acid, 30%	B	0-2
33.	Nitric Acid, 70%	B	2-3
34.	Phenol, 90%	A	0-2
35.	Phosphoric Acid, 85%	B	0-1
36.	Silver Nitrate Saturated	B	0-1
37.	Sodium Hydroxide 10%	B	0-2
38.	Sodium Hydroxide 20%	B	0-2
39.	Sodium Hydroxide 40%	B	0-2
40.	Sodium Hydroxide Flake	B	0
41.	Sodium Sulfide Saturated	B	0
42.	Sulfuric Acid, 33%	B	0-1
43.	Sulfuric Acid, 77%	B	0-1
44.	Sulfuric Acid, 96%	B	1-3
45.	Sulfuric Acid 77% & Nitric Acid 70% equal parts	B	1-3
46.	Toluene	A	0
47.	Trichloroethylene	A	0
48.	Xylene	A	0
49.	Zinc Chloride, Saturated	B	0

2.16 METAL FABRICATIONS

A. Applicability: This section applies to metal fabrications, including, but not limited to, pipe drop enclosures, shelving support systems, metal-framed laboratory tables, cylinder racks, and other miscellaneous brake-formed and shop fabricated components and trim, such as required for overhead service carriers.

B. Materials:
   1. Steel: Cold-rolled furniture stock sheet steel, prime grade, roller leveled.
      a. Steel shall be treated at the mill to be free of scale, ragged edges, deep scratches, or other injurious effects.
      b. All gauges indicated are to be U.S. standard.

C. Finish Requirements:
   1. Paint finish for steel laboratory products shall utilize a dry coating process with minimal waste generation. Liquid-applied coatings shall not be acceptable. Manufacturer shall supply documentation that waste generated during the painting process, is a solid, non-hazardous material.
      a. Pretreatment: Finish process shall incorporate a phosphate conversion coating during the pretreatment/cleaning operation.
      b. Operator Protection: The painting process shall be cleanly contained, have no solvent odor and be performed in an air-conditioned room.
      c. VOC (Volatile Organic Compounds) emissions shall not exceed 0.29 lbs per gallon (35 g/L).
      d. Offgasing: No further emissions or “Offgasing/Decomposition” vapors shall occur at room temperature from installed finished parts.
   2. Preparation: After the units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish to the metal and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a heated cleaner/phosphate solution and pretreated with iron phosphate spray followed by a neutral final seal prior to application of final finish. The strength of each solution shall be monitored by filtration to insure consistent quality. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.
   3. Application: Electrostatically apply powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:
      a. All surfaces, exterior or interior, exposed to view, shall receive sufficient powder coat to achieve an average 1.5 mil (38 µm) film thickness with a minimum 1.2 mil (30 µm) film thickness and shall have smooth satin luster.
      b. Backs of cabinets and other surfaces not exposed to view shall have sufficient powder coat to achieve an average 1.0 mil (25 µm) film thickness.
   4. All drawer bodies to be finished in matching color.
   5. Concealed interior parts shall receive corrosion-resistant treatment.
   6. Finish must be UV stable.
   7. Color: As selected by the Architect.

D. Finish Performance Requirements:
   1. Manufacturer shall submit metal finish performance testing results. Testing to be performed by independent testing agency.
   2. Chemical Resistance:
      a. Test procedure: Place samples on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73+ 3F (23(+ 2(C) and 50+ 5% relative humidity, or the currently accepted guideline set by ASTM. Test the samples for chemical resistance using forty-nine different chemical reagents by one of the following methods. For both methods, leave the reagents on the sample for a period of one hour. Wash off the sample with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73± 3°F (23°± 2°C) and 50± 5% relative humidity, or the currently accepted guideline set by ASTM

1). Method A: Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the sample. The cotton ball shall remain in contact with the sample for the duration of the test.
2). Method B: Test non-volatile chemicals by placing five drops of the reagent on the surface of the sample and covering with a 24mm watch glass, convex side down.

b. Rating System: Evaluations shall use the following rating system:

Level 0	No detectable change.
Level 1	Slight change in color or gloss.
Level 2	Slight surface etching or severe staining.
Level 3	Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

c. Acceptance Level:
1). Individual test results for the specified 49 reagents shall be within the Range for that reagent as specified on the table below.
2). There shall be no more than four (4) Level 3 conditions.

d. Table of reagents:

Test No.	Chemical Reagent	Test Method	Range
1.	Acetate, Amyl	A	0-1
2.	Acetate, Ethyl	A	0-2
3.	Acetic Acid, 98%	B	0-3
4.	Acetone	A	0-1
5.	Acid Dichromate, 5%	B	0-1
6.	Alcohol, Butyl	A	0-1
7.	Alcohol, Ethyl	A	0-1
8.	Alcohol, Methyl	A	0-1
9.	Ammonium Hydroxide, 28%	B	0
10.	Benzene	A	0-2
11.	Carbon Tetrachloride	A	0-1
12.	Chloroform	A	0-2
13.	Chromic Acid, 60%	B	0-2
14.	Cresol	A	0-2
15.	Dichloroacetic Acid	A	0-3
16.	Dimethylformamide	A	0-2
17.	Dioxane	A	0-2
18.	Ethyl Ether	A	0-1
19.	Formaldehyde, 37%	A	0-1
20.	Formic Acid, 90%	B	0-3
21.	Furfural	A	0-3
22.	Gasoline	A	0
23.	Hydrofluoric Acid, 37%	B	0-2
24.	Hydrofluoric Acid, 48%	B	0-3
25.	Hydrogen Peroxide, 30%	B	0-1
26.	Iodine, Tincture of	B	0-2
27.	Methyl Ethyl Ketone	A	0-2
28.	Methylene Chloride	A	0-2
29.	Monochlorobenzene	A	0-2
30.	Naphthalene	A	0-1
31.	Nitric Acid, 20%	B	0-1
32.	Nitric Acid, 30%	B	0-1
33.	Nitric Acid, 70%	B	0-3
34.	Phenol, 90%	A	0-2
35.	Phosphoric Acid, 85%	B	0-1
36.	Silver Nitrate Saturated	B	0
37.	Sodium Hydroxide 10%	B	0
38.	Sodium Hydroxide 20%	B	0
39.	Sodium Hydroxide 40%	B	0-1
40.	Sodium Hydroxide Flake	B	0
41.	Sodium Sulfide Saturated	B	0

Test No.	Chemical Reagent	Test Method	Range
42.	Sulfuric Acid, 33%	B	0
43.	Sulfuric Acid, 77%	B	0
44.	Sulfuric Acid, 96%	B	2-3
45.	Sulfuric Acid 77% & Nitric Acid 70% equal parts	B	1-3
46.	Toluene	A	0-1
47.	Trichloroethylene	A	0-1
48.	Xylene	A	0-1
49.	Zinc Chloride, Saturated	B	0

3. Hot Water Test
   a. Test Procedure: 190°F to 205°F (88°C to 96°C) hot water shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.5 cc) per minute) on the finished surface, which shall be set at an angle of 45°, for a period of 5 minutes.
   b. Acceptance Level: After cooling and wiping dry, the finish shall show no visible effect from the hot water.
4. Paint Adhesion on Steel Test
   a. Test Procedure: Test shall be based on ASTM D2197-86 “Standard Method of Test for Adhesion of Organic Coating.” Two sets of eleven parallel lines 1/16 inch (1.587 mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid to 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush surface lightly with a soft brush for one minute. Examine under 100 fc (1076 lux) of illumination.
   b. Acceptance Level: Ninety or more of the squares shall show finish intact.
5. Impact Test
   a. Test Procedure: Drop a 1 lb (0.4536 kg) ball (approximately 2 inch (50.8 mm) diameter from a distance of 12 inches (305 mm) onto a flat horizontal surface, coated to manufacturer’s standard manufacturing method.
   b. Acceptance Level: No visual evidence to the naked eye of cracks in the finish due to impact.
6. Paint Hardness on Steel Test
   a. Test Procedure: Paint film shall be tested with pencils of various hardnesses. Pencils shall have a wide, sharp edge. Pencils shall be pushed across surface in a chisel-like manner.
   b. Acceptance Level: Finish film shall not rupture from a sharpened 4H pencil.

2.17 STAINLESS STEEL FABRICATIONS

A. Applicability: This section applies to stainless steel fabrications, including, but not limited to, work surfaces, canopy hoods, drying racks, sinks and scullery sinks, stainless steel pipe drop enclosures, and other miscellaneous brake-formed and shop fabricated stainless steel components and trim as shown on the drawings.

B. Manufacturers:
   1. Inter Dyne Systems, Inc., 676 Ellis Road, Norton Shores, MI 49441 Tel: 231 799-8760.
   2. Kloppenberg & Co., 2627 West Oxford Avenue, Englewood, CO 80110 Tel: 303 761-1615.
   3. Approved substitution/equal.

C. Materials and Finishes:
   1. Unless otherwise noted stainless steel shall be Type 304 and shall be of gauge indicated on Laboratory Furnishing drawings or this specification.
   2. All fabrications shall have exposed surfaces ground and polished to a Number 4 satin finish.
   3. All stainless steel nuts, screws, bolts, and rivets, etc., shall be of the same type stainless as in the sheet material and shall have a tumbled finish closely resembling that of a Number 4 finish.
   4. All stainless steel welding material shall be of type similar to the sheet material or a richer quality. All welds shall be made without discoloration and shall be ground, polished, and passivated to blend harmoniously with a Number 4 satin finish. All joints in stainless steel tops and work surfaces shall be welded.

D. Work Surfaces:
   1. Thickness: 16 gauge (1.6 mm).
   2. Fabrication:

a. Edges: Flanged down the same dimension as the adjacent non-stainless top, with 1 inch (25 mm) being a minimum and returned over a perimeter metal frame to simplify securing top material to cabinet or structural frame.
b. Reinforcment: Under-surface shall be reinforced with full length 16 gauge (1.6 mm) structural metal channels as required to insure rigidity and prevent buckling, warping, or oil canning. Where bench-mounted fittings are indicated on the drawings, provide top reinforcement to allow for rigid, secure mounting of fittings.
c. Undercoating: Underside of top shall have a heavy mastic agent coating providing sound deadening.
d. Stainless steel sides and back-splashes, where indicated, shall be integrally welded to top and finish as indicated above. The back side of exposed backsplashes shall be finished to match front and sides.
e. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Verify size of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 inch (3 mm). After sawing, rout and file cutouts to ensure smooth, crack-free edges with no burrs.

3. Tops with Sinks: Tops and sinks shall be integral, fabricated with a marine edge and shall be pitched to sink bowl for proper drainage. Marine edges shall be seamless die-formed.
4. Flat Stainless Steel Work Surfaces: (Without marine edge or sink) shall have an integrally coved back splash and bull-nose at front of work surface.
5. Joints: Fabricate work surfaces in the largest sections practical for delivery to the job site. All joints shall be field-welded, ground smooth, and polished on-site to create a continuous work surface.

E. Laboratory Sink: Integral one piece construction with stainless steel work surface.
1. Thickness: 18 gauge (1.3 mm thick), unless otherwise noted.
2. Construction: Sink units shall be designed and fabricated with sufficient reinforcement to prevent oil canning. All sink joints shall be butt-welded, ground smooth by the heliarc welding process. Inside radii shall be 1 inch (25 mm). Bottoms shall be pitched to the drain indent. No soldering will be permitted in connection with sink construction. Sink bowl dimensions given are inside dimensions. Underside shall have a heavy mastic agent coating providing sound deadening.

F. Scullery Sink: Stainless steel top with integral sink bowls in sizes as shown. The requirements for stainless steel tops and sinks described above shall govern in its entirety. Backsplash, marine edge and drain boards shall be provided as indicated in Laboratory Furnishings plans.
1. Thickness: 14 gauge.
2. Construction: Front, bottom and back of sink compartments shall be formed of one sheet of material with integral 1 ½ inch (40 mm) roll rim, extending full length at front and ends of compartments and drainboards. Compartment ends and partitions shall be electrically welded into place. Drainboards shall pitch from 2 inches at rolled rim and ends to 2 ½ inches (65 mm) below rim at compartments. Bottoms shall be pitched to the drain indent. Sink units shall be designed and fabricated with sufficient reinforcement to prevent oil canning. All sink joints shall be butt-welded, ground smooth by the heliarc welding process. Inside radii shall be 1 inch (25 mm). No soldering will be permitted in connection with sink construction. Sink bowl dimensions on drawings are inside dimensions. Underside shall have a heavy mastic agent coating providing sound deadening.
3. Legs: Sinks shall be supported on stainless steel square tube legs with stainless steel leveling guides.
4. Accessories: Provide Elkay LK-86-RT, or approved, waste fitting at each compartment of stainless steel construction with strainer, overflow and lever handle. Provide tailpiece compatible with laboratory waste piping system. Refer to Division 22 for piping requirements.
5. Coordination: Coordinate scullery sink design with the requirements of any undercounter equipment (such as dishwashers and glassware washers), as shown on the Laboratory Furnishings drawings. Provide intermediate, end, and trim panels to enclose the undercounter portions of the scullery sink at equipment locations.

G. Canopy Hood: Provide stainless steel canopy with all hangers and miscellaneous hardware at locations and sizes as indicated on the Laboratory Furnishing drawings.
1. Thickness: 18 gauge.

2. Construction: Provide reinforcing necessary to prevent "oil canning" or deflection of panel between supports. All corners and joints shall be welded, ground smooth and free of all defects. Welded joints with visible burn marks will not be accepted.
3. Accessories: Provide stainless steel hangers and miscellaneous support hardware as required for a complete installation.
4. Provide dust- and vapor-proof light fixture with remote switch.
    a. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
        1). Canplas Industries Ltd., Barrie, Ontario, Canada L4M 4V3 Tel: 800 461-1771.
        2). Approved substitution/equal.
    b. Basis of Design: Canplas Canlet Series Vaporproof Lighting #6802-FCF-21-00-39.
    c. Construction/Features:
        1). Corrosion-resistant glass reinforced polyester thermoplastic fixture with brass screws and inserts and electrical box for ceiling mounting; U.L. listed for wet locations.
        2). Globe: Prismatic opal polycarbonate with no guard or reflector.
        3). Grounding screw.
        4). Hub-to-hub grounding via an internal bonding frame.
        5). External and internal gaskets for a water-tight seal.
    d. Ballast: Electronic, 120-volt.
    e. Lamp: 26 W compact fluorescent.
    f. Color: Stone Gray.
    g. Install in accordance with the requirements of Division 26.
5. Provide exhaust duct transition piece for mechanical connection above the ceiling designed for 100 cfm/foot (557 m^3/h per meter) of hood length.

2.18 SLOTTED CHANNEL FRAMING

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.
    1. Unistrut, 35660 Clinton Street, Wayne, MI 48184 Tel: 800 521-7730.
    2. Power Engineering Co. (Powerstrut), 420 Boston Turnpike, Shrewsbury, MA Tel: 800 274-1303.
    3. Kumar Industries (Nu-Strut), 4881 Chino Ave., Chino, CA 91710 Tel: (909) 591-0722.
    4. Cooper B-Line Inc. (B-Line), 509 West Monroe St., Highland, IL 62249 Tel: (618) 654-2184.
    5. Approved substitution/equal.

B. Materials: Channel and framing members shall be fabricated from steel conforming to the following requirements:
    1. Framing Members:
        a. Concealed Framing Members and Fittings: ASTM A570 GR 33.
        b. Exposed Framing Members and Fittings: ASTM A446 GR A with zinc coating conforming to ASTM A525.
        c. Stainless Steel Framing Members and Fittings: ASTM A240 (Type 304), where indicated.
    2. Fittings:
        a. Concealed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307.
        b. Exposed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307. Exposed fittings shall receive zinc coating conforming to ASTM A525.
        c. Stainless Steel Fittings and Hardware: Sintered Nuts shall be of ASTM B783 (Type 316N2-33) stainless steel and fittings shall be of ASTM A240 (Type 304) stainless steel. Stainless steel fittings and hardware shall be used with stainless steel framing members, or where indicated.
    3. Thickness: 12 gauge, unless noted otherwise.
    4. Size: 1 5/8 inch x 1 5/8 inch cross-section, unless noted otherwise.

C. Components:

1. The following components shall be provided, unless otherwise noted:
   a. Framing Channel: 1 5/8 inch x 1 5/8 inch x 12 gauge: Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equal.
   b. Suspended Framing Channel, 3 ¼ inch x 1 5/8 inch x 12 gauge: Unistrut P5000, Powerstrut PS 100, Kumar Industries N-150, B-Line Systems, Inc. B11, or equal.
   c. 90° Angle Fitting: 4 1/8 inch x 3½ inch x ¼ inch with two holes, each leg: Unistrut P1325, Powerstrut PS 607, Kumar Industries N-1123, B-Line Systems, Inc. B104, or equal.
   d. 135° Angle Fitting: 3 inch x 2 5/16 inch x ¼ inch with one hole, each leg: Unistrut P1546, Powerstrut PS 633-45°, Kumar Industries N-1425, B-Line Systems, Inc. B154, or equal.
   e. T-Shaped Flat Plate Fitting: 5 3/8 inch x 3½ inch x ¼ inch plate, T-shaped, with four holes: Unistrut P1031, Powerstrut PS 714, Kumar Industries N-1022, B-Line Systems, Inc. B133, or equal.
   f. Wing Shape Fitting, 9 5/32 inch x 3 7/8 inch ten holes, two holes in each wing section and two holes in each of three channel section sides: Unistrut P2347, Powerstrut PS 913, B-Line Systems, Inc. B273.
   g. Vertical Posts: 3¼ inch x 1 5/8 inch x 12 gauge, double channel section: Unistrut P1001, Powerstrut PS 200 2T3, Kumar Industries N-200-A, B-Line Systems, Inc. B22A, or equal.
   h. Horizontal Support Members: 1 5/8 inch x 1 5/8 inch x 12 gauge framing channel with 13/32 inch x 3 inch slotted holes, 4 inches on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S, or equal.
   i. Slotted Hole Framing Channel, 1 5/8 inch x 1 5/8 inch x 12 gauge framing channel with 13/32 inch x 3 inch slotted holes, 4 inches on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S.
   ~~j. Slotted Framing Channel for installation in Chemical Fume Hoods, 1 5/8 inch x 13/16 inch x 16 gauge Type 316 stainless steel framing channel: Unistrut P4000 SS, Powerstrut PS 560 SS, Kumar Industries, B-Line Systems, Inc.~~
      ~~1). Attach channel to side of fume hood with 2 5/8 inch x 1 7/8 inch x 1/8 inch, 4 hole, stainless steel 90º fitting: Unistrut P6325 SS, Powerstrut, Kumar Industries, B-Line Systems, Inc.~~ ***ADD-3***
   k. Diagonal Brace Supports: Framing Channel, 1 5/8 inch x 1 5/8 inch x 12 gauge: Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equa.
   l. Closure Strip: 0.04 inches thick snap-in cover for framing channel: Unistrut P3184, Powerstrut PS 6152, Kumar Industries N-1920, B-Line Systems, Inc. B217-24, or equal. Provide closure strips over all exposed vertical post sections.
   m. End Caps: 0.06 inches thick for framing channel: Unistrut P1280, Powerstrut PS 707, Kumar Industries N-2500, B-Line Systems, Inc. B205, or equal. Provide end caps for all exposed horizontal framing channels.
   n. Ceiling Escutcheon: Provide 18 gauge steel, finished to match framing members, as indicated on the Laboratory Furnishing drawings, at ceiling penetrations.
   o. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.
2. Service Struts and Ledging:
   a. 16 gauge, 13/16 inch x 1 5/8 inch cold-formed framing uprights: Unistrut P4000, Powerstrut PS 560, Kumar Industries N-400, B-Line Systems, Inc. B56, or equal. Uprights shall be provided at 48 inches, maximum, and fastened top and bottom by two adjustable U-shaped spreaders.
   b. U-shaped spreaders: 12 gauge by 1½ inch (45 mm) wide by length required, galvanized steel.
   c. Locations:
      1). Provide to support tops at pipe service chase space, support drain troughs, under fume hood superstructures, and other abnormal loads.
      2). Support struts with U-shaped spreaders shall be provided at 48 inches (1220 mm) on center below island and peninsula benches, as indicated on drawings. Support struts shall be provided along wall 48 inches (1220 mm) on center below island and peninsula benches. Struts will be used to support piped and electrical services installed under Divisions 22, 26, and 27. Provide all bolts, expansion sleeves, and fastening devices for a complete assembly. Pipe and conduit hangers shall be provided by Division 22, 26, and 27 installers.
3. Heavy Duty Wall Shelving:

a. Shelf Standards: Framing channel, spaced equally, 36 inches on center, maximum. Secure to wall. Provide all bolts and fastening devices for a complete assembly.
b. Brackets: Cold-formed framing channel brackets, as required for maximum cover of shelf depth:
1). Shelves at least than 9 inches and less than 11 inches deep: Unistrut P1769, Powerstrut PS 732-8, B-Line Systems, Inc. B187, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
2). Shelves at least than 11 inches and less than 13 inches deep: Unistrut P1771, Powerstrut PS 732-10, B-Line Systems, Inc. B541, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
3). Shelves at least 13 inches and less than 15 inches deep: Unistrut P1773, Powerstrut PS 732-12, B-Line Systems, Inc. B289-12, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
4). Shelves at least 15 inches and less than 17 inches deep: Unistrut P1775, Powerstrut PS 732-14, B-Line Systems, Inc. B289-14, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
5). Shelves at least 17 inches and not exceeding 20 inches deep: Unistrut P1777, Powerstrut PS 732-16, B-Line Systems, Inc. B290, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.

4. Cylinder and Dewar Restraint:
a. Swivel Hanger: 1 ¾ inch long by 3/8 inch diameter link welded to threaded stud; provide two per cylinder: Unistrut M2350, Powerstrut PS205, Kumar N-2911, B-Line 446B.
5. Overhead Support Grid
a. Exposed horizontal support members for user attachment, 3¼ inch x 1 5/8m inch x ¼ inch framing channel: Unistrut P5000, Powerstrut P 100, Kumar Industries N-150, B-Line Systems, Inc. B11.
6. Finish:
a. Provide finish coating for all cold-formed framing components, except for stainless steel components.
b. Concealed Framing Members and Fittings: Rust inhibiting acrylic enamel paint applied by electrostatic deposition, after cleaning and phosphating, and thoroughly baked. Finish shall withstand a minimum of 400 hours salt spray when tested in accordance with ASTM B117. Color: Green.
c. Exposed Framing Members and Fittings: Factory applied epoxy powder coat. Color: To be selected by the Architect.

2.19 SEALANT

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
1. Dow Corning Corporation, P.O. Box 994, Midland, MI 48686 Tel: 989 496-7881.
2. General Electric Company, 260 Hudson River Rd., Waterford, NY 12188 Tel: 800 255-8886.
3. Approved substitution/equal.

B. Basis of Design: Dow Corning 732 Multi-Purpose Sealant, GE Silicones RTV 100 Series, or equal.

C. Characteristics:
1. Type: One-part silicone rubber, MIL-A-46106.
2. Physical form: Non-slumping paste.
3. Cure: Cures at room temperature on exposure to water vapor in the air.
4. Authorizations:
a. FDA Regulation No. 21 CFR 177.2600.
b. USDA Rating P1.
c. NSF Rating C2.
d. UL 150 C Rating, File No. E40195(N).
5. Properties:
a. Tack Free Time: 45 minutes, maximum.
b. Durometer, Shore A Hardness: 20, minimum.
c. Tensile Strength: 220 pounds per square inch, minimum.
d. Elongation: 350 percent, minimum.

e. Extrusion Rate: 220 to 525 grams per minute.

PART 3 EXECUTION

3.1 SITE CONDITIONS

A. Inspection:
   1. Prior to installation of the work of this Section, carefully inspect the installed work specified in other Sections and verify that all such work is complete to the point where this installation may properly commence.
   2. Verify that all work may be installed in complete accordance with the original design, reviewed submittals, and the manufacturer's recommendations.

B. Discrepancy: In the event of discrepancy, immediately notify the Architect.

3.2 INSTALLATION

A. Coordinate work with any Owner furnished and/or installed components indicated on drawings.

B. General: Assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining units to a tolerance of 1/16 inch (1.5 mm).

C. Cabinets:
   1. Install cabinets to create a plumb, level, true and straight installation.
   2. Installation of metal and stainless-steel casework fixed cabinets shall utilize the internal leveling devices. Do not use shims.
   3. Installation of wood casework shall be performed using shims. Shimming shall be minimized as much as possible, yet be sufficient to achieve a level and plumb condition.
   4. Installation shall maintain the required height of countertops. ADA-height countertops shall not exceed the heights off the finish floor as indicated.
   5. Where floor conditions require shimming or leveling of more than ¾" at any point, do not install casework in those locations. Notify the contractor and design team that remedial measures will be required to bring the floors closer to a level situation.
   6. Securely fasten wall units to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets. Verify that all required backing and reinforcement necessary to support wall-mounted units is in place, secure, and accurately located.

D. Installation materials:
   1. Installation of wood casework may involve the use of shims, spacers, cleats, straps and other such items of either metal or wood composition.
   2. Installation of metal casework shall use spacers, cleats, and straps of galvanized steel, epoxy-coated steel, or stainless steel. No wood materials of any sort shall be part of the permanent installation of metal casework.

E. Laboratory Tops:
   1. Scribe tops as necessary for close and accurate fit.
   2. Field Joints: Factory-prepared and identical to factory joints, locate only where indicated on approved Shop Drawings. Field processing of top and edge surfaces is not acceptable, except as described by manufacturer in approved Submittal Data. Provide full length, one-piece tops and backsplashes wherever possible, and keep field joints to an absolute minimum.
   3. Abut top and edge surface in one true plane, with internal supports placed to prevent any deflection. Joints in top units shall be flush and the narrowest for the respective materials of construction. Cement joint in accordance with the manufacturers' specifications.
   4. All joints in stainless steel work surfaces shall be field-welded, ground smooth, and polished on-site to create a continuous work surface.

F. Sealant:
   1. Caulk edges of tops, backsplashes and side splashes to adjacent wall or other vertical surface with silicone sealant.

3.3 DESTRUCTIVE TESTING

A. The Owner, Architect, and/or Contractor may, at their own cost, elect to perform destructive testing on casework cabinet components (such as fronts, sides, etc.) to confirm compliance with the requirements of this specification. The casework manufacturer/installer should account for the de-installation, repair, and reinstallation, or replacement of one cabinet that may be selected for destructive testing.

3.4 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as approved by the Architect at no additional cost to the Owner.

B. Clean finished units, touch up as required, and remove and refinish damaged or soiled areas.

C. Cover tops with kraft paper or polyethylene sheeting after installation and all other means necessary for protection against scratching, soiling, and deterioration during remainder of construction period. Remove protection prior to final cleaning.

D. Clean counter tops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

END OF SECTION

SECTION 142423
HYDRAULIC ELEVATORS

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Passenger and Hospital type elevator units.
   2. Guide hoistway rails and brackets, cylinder and plunger.
   3. Drilled hole and casing for cylinder, including concrete fill.
   4. Pit buffers.
   5. Motors, pumps, piping, controls and wiring up to main switch.
   6. Sill angles and pit ladders.
   7. Hoistway beam (if required).

B. Related Sections:
   1. Section 033000 - Cast-in-Place Concrete: Machine Room floor.
   2. Section 096813 – Carpet Tile: Carpet tile flooring in elevators.
   3. Mechanical: Pit drainage.
   4. Electrical: Electrical power to machine room including main switch and breaker.

1.2 REGULATORY REQUIREMENTS

A. Conform to:
   1. ANSI A17.1 - American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks.
   2. ANSI A17.16 Supplement to Safety Code for Elevators and Escalators.
   3. National Electrical Code.
   4. ANSI A17.2 - American National Standard Practice for Inspection of Elevators, Escalators, and Moving Walks.
   5. Americans with Disability Act (ADA).

B. Welding: AWS D1.1.

1.3 DESCRIPTION

A. Work of this Section includes complete and operational systems for one individual (separated) direct plunger type hydraulic passenger elevator (elevators) with motor and pump at bottom and immediately adjacent to each hoistway as follows:

B. Elevator #1 and #2 Passenger:
   1. Net Capacity: 4000 lbs.
   2. Speed: 150 fpm.
   3. Platform Size: 6’-0” wide by 8’-3” deep.
   4. Travel: As indicated.
   5. No. of Openings: 1 front.
   6. No. of Stops: ~~5~~ 3 per elevator ***ADD-3***
   7. Entrance Openings Size: 4’-0” wide by 7’-0” high.
   8. Door Operation: Double leaf, side opening horizontal sliding.

C. Elevator Operation:
   1. Simple collective.
   2. Attendant operation (Independent operation) with key lock to remove car from normal hall button calls.
   3. Home landing shall be First floor.
   4. Manual keyed lockdown capability required for all interior and exterior elevators.

D. Fire Emergency Service:
   1. Elevator operation shall comply with requirements of Santa Ana, California.
   2. Fire key shall be kept in suitable emergency box mounted adjacent to elevator.
   3. If smoke or heat sensing devices are wired to elevator system to initiate foregoing operation, install three position key switch, third position to override automatic initiation by sensing device.

1.4 COORDINATION

A. Review Contract Documents for compatibility with products prior to submitting a price. If conflicts are discovered notify Architect in writing. Provide an allowance included in price and identify the allowance as a separate line item to be used for changes to structural, mechanical, electrical, or other systems required to accommodate Provider's equipment.

1.5 SUBMITTALS

A. Samples: Submit in accordance with Section 013300.
   1. Submit samples of finishes and materials required for cars, operating and signal system fixtures and finish of hoistway entrances and doors.

B. Shop Drawings and Product Data: Submit in accordance with Section 013300.
   1. Clearly indicate space requirements, general arrangement of elevator equipment, and material being supplied. Show connections, attachments, reinforcing, anchorage and location of exposed fastenings, and location and amount of loads and reactions to be carried on building structure.
   2. Submit descriptive brochures or detail drawings of landing buttons, hall fixtures, car position indicators and car operating panels, car interior and hoistway doors and frames for review.

C. Maintenance Manuals: Include operations and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information. Include diagnostic and repair information available to manufacturer's and installer's maintenance personnel.

D. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.6 MAINTENANCE

A. Maintain entire elevator installation for ~~12 months after date of Substantial Completion of Work.~~ 2 years in accordance with the Facilities Lease Agreement. ***ADD-3***

B. Include systematic examination, adjustment and lubrication of elevator equipment, repair or replace worn electrical and mechanical parts of elevator equipment using only genuine standard parts produced by manufacturer of equipment concerned.

C. Replace seals, packing, and valves to maintain required factor of safety.

D. Perform work without removing cars during peak traffic periods.

E. Provide 24 hour emergency call back service during maintenance period.

F. Ensure that competent personnel handle maintenance service. Maintain locally adequate stock of parts for replacement or emergency purposes and have qualified personnel available at such places to ensure fulfillment of this service without unreasonable loss of time.

~~1.7 MAINTENANCE PROPOSAL~~

~~A. Proposal for maintenance of installed elevator work for period of 3 years after termination of regular maintenance as required in preceding article.~~

~~B. Proposal shall include stipulated sum for above stated time period with premiums due annually.~~

~~C. Maintenance shall include requirements stated in preceding article.~~ ***ADD-3***

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Engage elevator manufacturer or experienced Installer approved by elevator manufacturer who has completed elevator installation similar in material, design, and extent to that indicated for this Project and with record of successful in-service performance.

1.9 DELIVERY AND STORAGE

A. Deliver items or materials to site after area in which they are to be installed is ready to receive them in their place of final installation.

B. Store materials in storage area allotted and in such manner as to prevent deterioration, damage, or loss of their essential properties.

C. Fully protect moveable and operating equipment from weather.

D. Wrap and crate factory finished materials in manner to protect their finishes.

1.10 POWER CHARACTERISTICS

A. Elevator Apparatus: Volt as indicated by Electrical, phase as required, 60 Hz alternating current.

B. Lighting: 120 volt, 60 Hz alternating current.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Hydraulic Elevators by Mitsubishi.
   1. Controller: ***ADD-2***
      a. Manufacturers:
         1) Smartrise, http://www.smartrise.us/
         2) Elevator Controls, http://elevatorcontrols.com/index.html
         3) MCE Inc., http://mceinc.com/
      b. Provide non-proprietary, on-board diagnostic controller. Outside tooling to service elevator is not acceptable.
   ~~2. Non-proprietary controllers by MCE Inc., http://mceinc.com , or District approved equal.~~ ***ADD-2***
   3. Warranty: 2 years.

B. Other Acceptable Manufacturers: Mitsubishi, Dover, Oliver & Williams, ~~Otis Elevator Company~~, Schindler Group, ~~ThyssenKrupp,~~ or District approved equal. ***ADD-2***

2.2 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: ANSI A17.1.

B. Sheet Steel: ASTM A446, G90 Coating designation, stretcher levelled commercial grade.

C. Stainless Steel: ASTM A167 Type 302/304, No. 4 finish. Run grain of belting in direction of longest dimension.

D. Aluminum: ASTM B221 extruded alloy; ASTM B209 sheet alloy 6063; enameling quality.

E. Plywood: PS 1, Western Softwood; (Douglas Fir) good one side, fire retardant treated per following requirements:
   1. Each piece to bear:
      a. UL FR-S rating (flame spread and smoke developed less than 25),
      b. Complying with extended 30-minute tunnel test, ASTM E84 or UL 723
      c. Meet interior Type A requirements in AWPA Standard C-27 for plywood.
      d. And shall be registered for use as a wood preservative by the U.S. Environmental Protection Agency.
   2. Treatment to provide protection against:
      a. Termites.
      b. Fungal decay.
   3. Treatment to be free of:

a. Halogens.
b. Sulfates.
c. Ammonium phosphate.
d. Formaldehyde.

4. After treatment: Material shall be dried to an average moisture content of 15 percent or less for plywood and 19 percent or less for other lumber.
5. Coat surfaces cut after treatment with heavy brush coat of same fire-retardant chemical
6. Manufacturers:
   a. Dricon by Arch Wood Products.
   b. Pyro-Guard by Hoover Treated Wood Products.

F. Plastic Laminate: FS L-P-508; color, texture, pattern selected by Architect.

2.3 OPERATING EQUIPMENT

A. Motors, pumps, controllers, hydraulic fluid reservoir, cylinder, casing, plunger, piping, guide rails, buffers, buttons, wiring, indicators, and hardware and fittings to provide fully operational elevator.

1. Pump to be mounted on 1" static deflection spring. ***ADD-2***
2. All hydraulic lines to be installed on neoprene isolators if suspended from the ceiling, or on spring isolators with 0.3" static deflection if floor-mounted.
3. Provide muffler on the discharge oil line.
4. Provide oversized opening in the slab or wall for the oil line penetration through a sleeve filled with some resilient material or firestopping.
5. Elevator cylinder to be mounted on neoprene pads (Mason Industries type Super W, OAE) with 0.1" static deflection.
6. All electrical connections should have flexible conduit connecting to the electrical equipment.

B. Back-up power source: Provide with standby power source unless elevator is shown to be connected to emergency power generator.

C. Manual keyed lockdown capability required for all interior and exterior elevators.

2.4 FINISHES

A. Primer: Shop coat, (zinc dust/zinc oxide) alkyd.

B. Galvanizing: ASTM A526, G90 coating designation.

C. Enamel: Shop applied baked enamel of colors selected by Architect.

D. Corrosion Protection: Corrosive resistant paint and covering wrap as recommended by elevator manufacturer for specific soil conditions at site.

2.5 FABRICATION

A. Machine: A.C. type specifically designed for elevator service having motor, pump, tank valves and muffler mounted and aligned on steel bedplate.

B. Cylinder/Plunger: Machined polished steel tube having internal couplings where jointed, welded stop on bottom, sliding in high strength steel pipe cylinder having closed bottom and stuffing box with packing gland at top and necessary piping connections.

C. Car: Sheet steel enclosure with structural steel frame and bracing, 3/4 inch fire retardant treated plywood floor and wall cladding fastened with hidden mechanical fasteners. Power operated hollow steel doors with track, rollers and frame.

D. Car Finish: Color and finishes as selected by Architect from manufacturer's standard finishes. Provide cab with swing return front.

E. Hoistway Entrances: ~~Baked enamel finish on steel.~~ Stainless steel, type 302/304 No. 4 finish. ***ADD3***

2.6 FINISHING

A. Non-exposed to View Surfaces:

1. Structural and Non-exposed Ferrous Metal Surfaces: Free surfaces of rust, oil or grease, clean with solvent, prime with 2 coats structural steel grade primer.
2. Field Welds: Chip and clean away oxidation, flux or residue, wire brush clean, apply 2 coats of primer.
3. Wood: One coat primer and 2 coats semi-gloss alkyd enamel.

B. Exposed to View Surfaces (in car, machine room and hoistway entrances).
1. Stainless Steel: Type 302/304 No. 4 finish.
2. Plastic Laminate: Wood grained or solid color furniture finish, 0.060 inch thick, pattern and color as selected from manufacturer's standard range.
3. Baked Enamel: Clean, degrease zinc coated metal surface, one coat of zinc oxide primer sprayed and baked, 2 coats of semi-gloss enamel sprayed and baked, color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which work of this Section depends. Report defects to Architect in writing which may affect Work of this trade or equipment operation.

B. Ensure that shafts and openings for moving equipment are plumb, level and in line and that pit is to proper depth, waterproofed and drained with necessary access doors, cylinder opening, ladder, guard.

C. Ensure that machine room is properly illuminated, heated and ventilated and equipment foundations correctly located complete with floor and access door.

D. Before fabrication, take necessary job site measurements and verify where work is governed by other trades. Check measurements of space for equipment and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.

E. Ensure following preparatory work, provided under other Sections has been properly completed to receive elevator work:
1. Supply of electric feeder wires to terminals of elevator control panel, including fused main line switch or circuit breaker. Provision of hoistway outlets for car light, and for light in pit and outlets in machine room for light. Furnishing of electric power for testing and adjusting elevator equipment.
2. Provision of hoistway outlet for telephone.
3. Supply of power for emergency cab lighting and ventilation from power panel specified in Division 26 Electrical fed by building emergency circuits.
4. Machine room enclosed and protected from moisture, with lockable door.

F. Supply in ample time for installation, inserts, anchors, pipe sleeves, bearing plates, brackets, supports and bracing including setting templates and diagrams for placement.

3.2 INSTALLATION

A. Perform work with competent mechanics skilled in this work and under direct control and supervision of elevator manufacturer's experienced foreman.

B. Set hoistway entrances in alignment with car openings and true with plumb sill lines.

C. Install machinery, guides, controls, car and equipment and accessories in accordance with manufacturer's instructions, applicable codes, and standards to provide quiet, smoothly operating installation, free from sidesway, oscillation, or vibration.

D. Excavate for plunger and cylinder, set in place plumb and accurate and enclose with 3000 psi concrete.

E. Mount machine immediately adjacent to hoistway on concrete foundation provided under Section 033000 - Cast-in-Place Concrete. Isolate and dampen machine vibration with properly sized sound reducing anti-vibration pads.

F. Install and hookup piping between machine and cylinder.

G. Erect hoistway sills, headers and frames prior to erection of rough walls and doors; erect fascias and toe guards after rough walls finished.

H. Grout sills and hoistway entrance doors.

I. Provide stainless steel license holders in each elevator car to suit certificate issued. Design holder with nonvisible tamperproof fastenings.

J. Provide wall hooks and protective mats for walls of elevator car No. 2.

K. Locate hall buttons and indicators as detailed on Drawings.

3.3 CLEANING

A. Prior to final acceptance remove protection from finished or ornamental surfaces and clean and polish surfaces with due regard to type of material.

B. At completion of work of this Section, remove tools, equipment and surplus materials from site.

3.4 ADJUST AND BALANCE

A. Make necessary adjustments of equipment to ensure elevator operates smoothly and accurately.

3.5 PROTECTION

A. Locate and protect moveable equipment and controls in such way that they can only be operated by authorized persons.

3.6 INSPECTION

A. Obtain and pay for inspections and permits and make such tests as are required by regulations of authorities. Make tests in presence of Architect.

B. Final inspection shall be after elevator installation, hoisting enclosure and machine room are complete.

C. Inspect installation in accordance with ANSI A17.2.

D. Deliver test certificates and permits to Architect.

3.7 INSTRUCTION AND MAINTENANCE

A. Instruct Owner's personnel in proper use, operation and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Confer with Owner on requirements for complete elevator maintenance program.

B. Make final check of each elevator operation, with Owner's personnel present and just prior to date of substantial completion. Determine that control systems and operating devices are functioning properly.

END OF SECTION

SECTION 211313
AUTOMATIC SPRINKLER SYSTEM

Revised, Addendum #3, 09/22/2017

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

A. Furnish all materials and labor for the detailed design and installation for (a) new fire sprinkler (wet-pipe) system(s), hereafter referred to as the "System(s)" in complete compliance with this Specification for the Santa Ana College Science Center project in Santa Ana, California.

B. The contract drawings and this Specification define the scope of work for the project. The contract drawings are intended to be engineered working plans only in accordance with NFPA 13 Chapter 22, and the Contractor's responsibilities are defined herein. Where conflicts occur between the Specification and the contract drawings, the bidder is instructed to request clarification prior to bidding. In general, should a conflict occur, this specification takes precedence over the contract drawings.

C. The work shall be subject to the terms and conditions contained in the "Construction Contract," agreement between the Contractor and the Owner.

All applicable fees, taxes, and permit costs for all work contained in this specification section shall be included in this Contractor's base bid.

D. Contractor shall be responsible for the review and compliance with this Specification section and the DSA approved plans and calculations. All work shall be performed in accordance with these Specifications and good engineering and installation practice. Modifications to these Specifications will NOT be accepted without the expressed written approval of Owner, Owner's Representative, and/or Owner's Insurance Carrier; herein referred to as the "Owner". It is Contractor's responsibility to document the required approvals of any such modifications prior to the execution of work. It is the Contractor's responsibility to document the intent to modify the approved design and document all required approvals of any such modifications deemed "major changes" based on DSA Policy PL 10-01 Section 4.3.1 prior to bid and prior to the execution of work. Change of the design by the contractor as outlined in Section 4.3.1 will NOT be accepted without the expressed written approval and coordination with the Owner.

E. It is the Contractor's responsibility to receive approval of any changes from the design drawings deemed "minor changes" as outlined in Section 4.3.2 of DSA Policy PL 10-01 using the DSA change order process and appropriate addenda. For changes to the design drawings which alter the design of the system and require a Field Change Document (FCD) to be prepared, the preparation of the FCD shall be the responsibility of the Contractor and review will be provided by the Engineer of Record. Changes or modifications which do not modify the design of the system (such as addition of bracing or changes in specified material) shall be addressed using a DSA change order and shall require approval of the Owner.

F. Contractor shall field verify all site conditions and information contained on the contract drawings and is responsible for the complete design and installation of the system(s) in accordance with the specifications. The contract drawings may not show all information necessary for installation of the system(s), but are intended to be used by Contractor for the purpose of preparing a bid. The contract drawings indicate the following:

1. Hydraulically calculated pipe routing and sizes.
2. Approximate routing and elevations of overhead piping.
3. Types and minimum quantities of sprinklers and valves.

4. Location of the new riser(s) for the System(s), and major points on the system, such as the fire department connection(s).
5. NFPA Hazard Classifications.
6. Additional information as required in the DSA AFSS Checklist.

G. There shall be no impairments to any of the adjoining building system(s) in any way due to the work provided for in this specification.

1.2 INTENT OF SPECIFICATIONS

A. The work performed pursuant to these specifications is to be complete in every respect, resulting in the System(s) installed in accordance with the applicable codes, standards, manufacturers' recommendations, and Underwriters Laboratories Inc. (UL) listings and/or Factory Mutual (FM) Global approval.

B. Upon completion of this work, and as a part of this contract, Contractor shall provide Owner with:
1. Complete information and "as-built" record drawings describing and depicting the entire system as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system at a future date.
2. Complete documentation of system(s) testing and Authority Having Jurisdiction (AHJ) acceptance.

C. Certification that Contractor's work has been inspected and tested, is installed entirely in accordance with the applicable codes, standards, manufacturers' recommendations and UL listings and/or FM approvals, and is in proper working order. Contractor shall use "Contractor's Material and Test Certificate(s)" as required by NFPA codes.

1.3 WORK INCLUDED

A. General: Furnish all materials and labor for the design, installation, and testing of new sprinkler system(s) throughout the new building in accordance with all applicable codes and requirements of this Specification.

B. Provide personnel to inspect and verify piping and sprinkler locations as indicated in the bid drawings. The contractor is responsible for any pipe routing changes, including offsets, required to install the new system(s).

C. Provide personnel to inspect and verify piping and sprinkler locations as indicated in the bid drawings. The contractor is responsible for any pipe routing changes, including offsets, required to install the new systems.

D. Sprinkler: Furnish and install all components necessary for the automatic sprinkler system(s) to result in (a) fully operational system(s). Provide appropriate water flow (pressure switch or vane type) and valve supervisory (tamper) to provide all monitoring of the System(s). Interface to the new fire alarm system shall be completed by the Fire Alarm Contractor, as specified in the Fire Alarm Specification

E. Sprinkler Zones – Where shown on the drawings and/or detailed in the specifications, fire sprinkler system zoning and alarms shall correspond to alarm and detection and/or smoke control zones at a minimum, one sprinkler zone is required for each full floor.

F. Water supply for the building will be served from the existing water main as shown on the drawings. Flow test information for the city water supply is listed on the drawings.

G. Standpipes – Provide Class I, manual wet standpipes at every required stair in the new Building as required to comply with Chapter 9 of the California Building Code and NFPA 14 (2013 edition with State of California ammendments) requirements. Hose connections shall be provided within enclosure/cabinet where indicated by Architect and/or Owner.

H. Standpipe Drain Riser: Provide two (2) inch drain riser at each standpipe in accordance with NFPA 14.

I. Drains: Provide all piped connections to the exterior of the building necessary to drain and test the sprinkler and standpipe systems. Drains shall terminate at the exterior of the building, or, when and where approved by Owner, at an interior drain capable of handling full flow conditions.

J. Provide updated record (as-built) drawings and hydraulic calculations to the Orange County Fire Authority (OCFA) and the Owner's Consultant for final approval.

K. Shields: Install shields where necessary to protect electrical equipment from sprinkler discharge. Shields shall be such that water spray from sprinklers is shielded from the intended equipment only. Shields shall not completely block water spray over the remainder of the area to be protected. Coordinate with electrical drawings for these locations.

L. Valves: Furnish and install all system control valve(s), main and inspector's test drain valves, and other appurtenances as required for a fully operable system. All system control valves shall be equipped with tamper switches for electronic supervision.

M. Painting: Painting of pipe and fittings shall be included throughout the building where the piping and fittings are exposed in public areas. The contractor must coordinate with the Owner regarding color matching and adjacent architectural features. This Contractor shall include one coat of latex primer, and one finished coat of latex paint. Pipe and fittings shall be painted red in mechanical and non-public areas (unless otherwise indicated on building plans or as directed by Owner) to indicate fire service use.

N. Submittals: Prepare and submit shop drawings, product data sheets, hydraulic calculations, record drawings and other submittals required herein. Work is not to proceed until all required submittals have been approved by Owner and all AHJ. Contractor shall be responsible for the submission of the required materials to the owner and all approving authorities.

O. Tests: Each new sprinkler and/or standpipe system shall be tested in accordance with the requirements of NFPA 13 and NFPA 14, AHJ and the Owner. The Sprinkler contractor shall also attend all fire alarm tests to aid in testing sprinkler system monitoring devices. Contractor shall be responsible for carrying out all required tests. Separate tests may be required by the Owner and AHJ.

P. Approvals: Obtain all approvals required for the work of this section from all AHJ and Owner.

Q. Fees: ~~Pay all fees required to obtain permits, inspections and final approval of the work in this section.~~ All DSA related permits and fees are to be paid by the District. Any other inspections, permits or business related fees required by local agencies and/or jurisdictions are to be covered by the Contractor. ***ADD-3***

R. Coordination: Coordinate work with all other trades working on the project, and with the other fire protection system(s) specified elsewhere.

S. Unit Additions: Contractor shall provide unit pricing for any additional work or services as described in the Bid Format sheets.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Underground Water Supply Piping: Water supply piping to (a) finished standard cast iron companion flange(s) left plumb and level, six (6) inches above the finished floor at point(s) shown on the bid drawings and documents. Size of flange(s) and underground supply mains are as shown. Project point of connection shall be 6-inches above the finished floor of the ground level in the interior the building.

B. Post Indicator Valve (PIV) – a post indicator valve for the underground feed to the building shall be provided by others as indicated on the civil drawings.

C. Alarms: Wiring and connection to sprinkler system alarm and supervisory devices shall be provided by Fire Alarm Contractor as detailed in the Fire Alarm and Detection Specification.

D. Drains: Floor drains and other facilities for receiving discharge from sprinkler and standpipe system drains.

1.5 QUALITY ASSURANCE

A. All work shall conform to the requirements of the applicable editions and portions of the National Fire Protection Association (NFPA) Standards, locally adopted codes, including:

1. Title 24, Part 2, California Building Code (CBC) 2013 edition with City of Santa Ana and OCFA amendments
2. Title 24, Part 3, California Electrical Code (CEC) 2013 edition with City of Santa Ana amendments
3. Title 24, Part 9, California Fire Code (CFC) 2013 edition with City of Santa Ana and OCFA amendments
4. NFPA 13, 2013 edition, "Standard for the Installation of Sprinkler Systems" with State of California amendments.
5. NFPA 14, 2013 edition, “Standard for the Installation of Standpipe and Hose Systems” with State of California amendments.
6. NFPA 24, 2013 edition, "Private Fire Service Mains and Their Appurtenances" with State of California amendments.
7. NFPA 72, 2013 edition, "National Fire Alarm Code" with State of California amendments.

All work and materials shall conform to all Federal, State, and local codes and regulations governing this installation including all parts of Title 24 statewide California codes.

B. Code Conflicts: Should conflicts exist between the referenced NFPA Standards, Federal, State or local codes and this specification, it shall be Contractor's responsibility to bring the conflict to the attention of Owner for resolution. The contractor shall not attempt to resolve code conflicts with the local authority, independent of Owner. In general, in the event of a conflict, the most stringent of the requirements will apply.

C. Permit Fees: Contractor shall be responsible for filing all documents, paying all fees and securing all permits, inspections and approvals necessary for completing the scope of the work in this section.

D. Equipment: All devices, systems, equipment and materials furnished and installed shall be new and shall be submitted for approval by Owner. All sprinklers, pipe, fittings, hangers, valves, and other materials and equipment shall be UL Listed and/or FM approved for their intended use. All shall be acceptable to the AHJ when such agencies have listings of acceptable equipment.

E. Fittings: Fittings may be of the flanged, threaded, or grooved type. Welded outlets on cross-mains for riser nipples and/or branch lines, and for sprinkler outlets on branch lines will be permitted. All shall be UL Listed and/or FM approved for their intended use. The use of plain-end fittings to join steel pipe is not permitted.

F. Contractor Requirements: Contractor shall:

1. Hold all licenses and obtain all permits necessary to perform work of this type in the State of California. Copies of Contractor's licenses shall be provided with bid submittal.
2. Be regularly engaged, for the past five years in the design, installation, testing and servicing of automatic sprinkler systems for buildings of this type.
3. Contractor’s site supervisor will be at the job site at all times when work is actively in progress.

1.6 SPRINKLER SYSTEM DESIGN CRITERIA

A. Densities: Hydraulically designed and calculated sprinkler system(s) shall be installed in accordance with the construction documents. The system(s) has (have) been designed to produce discharge densities of:

1. 0.10 gpm/square foot over the hydraulically most remote 1,500 square feet in spaces designated as Light Hazard Occupancies.
2. 0.15 gpm/square foot over the hydraulically most remote 1,500 square feet in spaces designated as Ordinary Hazard Group 1 Occupancies.
3. 0.20 gpm/square foot over the hydraulically most remote 1,500 square feet in spaces designated as Ordinary Hazard Group 2 Occupancies.

B. Hose stream requirements: The calculations shall include a 100 gpm inside hose stream at the hose valve closest to the floor control valve assembly. The combined (inside and outside) hose stream for the calculations shall be 250 gpm.

C. Provide sprinklers throughout the facility including under ducts, stairs, and obstructions as required by NFPA 13. A unit additional price for sprinklers under ducts, stairs, or other obstructions wider than 4 feet required but not shown on the construction documents in excess of 25 shall be provided at the unit additional cost specified by the contractor in the bid format sheets. Base bid shall include 10 sprinklers in additions to those indicated in the drawing.

D. All branch line piping shall be minimum 1" nominal size. Branch line piping in gridded systems shall be minimum 1¼" nominal size. Threaded outlets on branch lines supplying sprinklers shall match the sprinkler threads, but shall be 1" NPT if supplying a sprig or drop.

1.7 SUBMITTALS

A. Shop Drawings: Contractor will be authorized to start the project or portions of the project when the shop drawings for the work are received, reviewed and approved by Owner and all AHJ. Installation prior to these approvals shall be at this Contractor's risk.

1. Shop drawings shall show all of the information required by the applicable NFPA codes for working plans as well as DSA AFSS Submittal Guidelines.
2. Shop drawings shall include a drawing legend sheet identifying:
   a. All symbols used on the drawings, by type of device or equipment, manufacturer and manufacturer's part number. This information shall correspond to the manufacturer's catalog data sheets and installation manuals.
   b. All conventions, abbreviations and specialized terminology used on the drawings, as necessary to understand and interpret the information contained therein.
   c. A complete drawing list identifying all drawings in the shop drawing package by title, drawing number and Specification cross reference.
3. Shop drawings shall be single line or architectural floor plan drawings, drawn to 1/8-inch equals 1 foot scale or larger (i.e., 1/4-inch, etc.), showing a key plan and all other information required by the applicable NFPA codes for shop drawings.

B. Product Data: Contractor shall submit a product data submittal with the shop drawings. Manufacturers' Data Sheets shall show the type and model of all equipment or material proposed. This information shall include type of pipe, hangers, valves, pipe fittings/joining methods, air compressors, releasing panels, detection equipment, sprinklers, waterflow devices, supervisory devices, fire department connections, escutcheons, and signage. When a Data Sheet shows more than one product, the specific proposed product shall be clearly indicated by arrows or other suitable means. All manufacturers' data sheets shall clearly show all UL listings and/or FM approvals for each product submitted.

C. Contractor shall provide hydraulic calculations in accordance with the requirements of NFPA 13, showing that the pipe sizes provided will produce adequate performance. A minimum safety factor of 10 psi or 10%, whichever is greater, of the available pressure at the required system flow (including all required hose stream demands) shall be demonstrated in the hydraulic calculations.

D. Four sets of shop drawings, product data sheets, and hydraulic calculations as described in parts A, B and C shall be submitted to Owner for review. Only complete submittals containing all required information for all work required in this section will be reviewed. Incomplete submittals will be returned to Contractor without being reviewed.

E. All drawings and diagrams shall be prepared on drawing sheets of uniform size, 30 by 42 inches minimum, and shall contain no extraneous information. Marked up electrical, HVAC, or similar drawings or copies of catalog data sheets are not acceptable in lieu of the required drawings or diagrams. All other information required for this submittal shall be submitted in one or more appropriately labeled (i.e., Contractor's name, project, submittal name/description and date) and indexed 3-ring binders.

F. All Drawings and diagrams shall include Contractor's title block, complete with drawing title, Contractor's name, address, date including revisions, and preparer's and reviewers initials. All drawings and diagrams shall be reviewed and stamped as required by the AHJ.

G. Samples: Within 30 days of authorization to proceed, Contractor shall submit to Owner for approval, samples of all types of proposed sprinklers, including types of finishes available and a complete list of where each type and finish will be installed.

H. Prior to start of installation, Contractor shall submit copies of all permits and approvals to Owner necessary to conduct this work. A minimum of one complete set of such permits and approvals shall be kept by Contractor at the job site and shall be available for review.

I. Contractor shall provide Owner with one copy of all documents that are reviewed and approved by the AHJ and/or local code authorities. These documents shall include, but not be limited to, the following:

1. Site inspection forms
2. Shop drawings
3. Final inspection forms
4. Workers compensation insurance

All documents shall include all required approval stamps, signatures or other information necessary to properly certify that the installation has been reviewed and accepted by the AHJ.

J. Operation and Maintenance (O&M) Manual: The Contractor shall provide Owner with an indexed 3-ring binder containing:

1. 11" x 17" reduced copies of the ‘as-built’ record drawings required below (Final submittal only).
2. Manufacturers’ catalog data sheets and installation manuals.
3. Copy of REG 4 testing procedures.
4. Copy of all test certificates and approvals.
5. A list of recommended spare parts and summary of spare parts provided.
6. A service directory, including a list of Contractor’s contact names and telephone numbers for service on the system, including emergency service as required elsewhere in these Specifications.

K. Draft O&M Manual: Within 30 days following the notice of authorization to proceed, Contractor shall submit to Owner three copies of the draft manual for approval, excluding test certificates and drawings. The draft manual will be reviewed for required content and approved or disapproved on that basis. Upon completion of the project, Contractor shall revise the approved, preliminary manual to reflect the system as installed and to coordinate the testing and maintenance schedule with the approved Contractor testing protocols. Any and all assigned fire protection device numbers shall also be indicated on Contractor's record drawings.

L. Final O&M Manual: Within 30 days of the completion of the work, two final copies of the approved manual with reduced drawings and test certificates shall be delivered to the Owner.

M. Record Drawings: Contractor shall provide and maintain on the site an up-to-date ‘as-built’ record set of approved shop drawing prints which shall be marked to show each and every change made to the sprinkler system from the original approved shop drawings. This requirement shall not be construed as authorization to deviate from or make changes to the shop drawings approved by Owner without written instruction from Owner in each case. These drawings shall be maintained in a current condition at all times and shall be made available for review immediately upon request during normal working hours throughout the installation.

N. Upon completion of the ‘as-built’ record drawings and before final approval, one set of reproducible ‘as-built’ record drawings shall be delivered to Owner. Upon approval by Owner, two sets of final record drawings shall be furnished to Owner. In addition, a record set of drawings shall be transmitted to Owner in the latest version of AutoCAD electronic format with any applicable executable, unarchiving files.

O. If Contractor's submittals, upon review by Owner, do not conform to the requirements of these specifications, Contractor shall be required to resubmit with modifications, within ten (10) working days of receipt of Owner's notification to Contractor. Contractor shall be responsible for Owner’s expenses for subsequent review of rejected submittals that were necessitated by Contractor's failure to make the requested modifications. Such extra fees shall be deducted from payments by Owner to Contractor.

1.8 WARRANTY AND EMERGENCY SERVICE

A. Contractor shall warrantee all materials and workmanship for a period of two (2) years beginning with the date of final acceptance of Contractor’s completed installation by Owner. Contractor shall be responsible during the design, installation, testing and warranty periods for any damage caused by Contractor (or its subcontractors) or by defects in Contractor’s (or its subcontractors') work, materials, or equipment.

B. Emergency Service: During the installation and warranty period, Contractor shall provide emergency repair service for the sprinkler system(s) within four (4) hours of a request by Owner for such service. This service shall be provided on a 24-hour per day, seven days per week basis.

1.9 SPARE PARTS AND SPECIAL TOOLS

A. Spare parts and special tools shall be provided to Owner prior to final acceptance, and shall be provided for each system riser location.

B. Spare Parts: Contractor shall install UL listed and/or FM approved spare sprinkler cabinets containing a minimum quantity of sprinklers, of each type, finish and temperature rating used in accordance with the requirements of NFPA 13, but not less than ten (10) spare sprinklers. Contractor shall provide two (2) sets of sprinkler wrenches compatible with each type of sprinkler provided in each cabinet. The cabinets shall be installed near the system riser(s) at location(s) approved by Owner. Contractor shall provide as many sprinkler cabinets as necessary to accommodate the required number of spare sprinklers, but a minimum of one spare cabinet per sprinkler riser location shall be provided.

C. Special Tools: Contractor shall supply Owner with two complete sets of special tools and equipment necessary to perform routine maintenance on the sprinkler systems.

1.10 FINAL ACCEPTANCE

A. Date of Final Acceptance will be established by Owner and shall be based on acceptance of the installation and required approved documentation by Owner and AHJ.

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment and system components furnished and installed shall be new and of first quality, and be listed by Underwriters Laboratories Inc. (UL), and/or approved by Factory Mutual (FM) for their intended use. All such equipment and system components shall be installed in accordance with the respective UL listings, FM approvals and California State Fire Marshal approved. All materials shall be acceptable to the Owner and the AHJ.

2.2 PIPE AND FITTINGS - GENERAL

A. Pressure ratings: Pressure ratings of all fittings shall meet or exceed maximum working pressures available within the system.

B. Corrosion protection: All piping and hangers, where exposed to the weather or installed in a corrosive atmosphere, shall be protected against corrosion. Piping and hangers in such areas shall be stainless steel and/or hot dipped galvanized. Piping having an external only galvanized finish in such areas is unacceptable.

2.3 ABOVEGROUND PIPING COMPONENTS

A. Pipe Sizes 2.5 inches (65 mm) and Larger.

1. Piping shall be ASTM A-53/A-135/A-795, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 8 inches (200 mm) and greater in diameter), Type E or Type S, Grade A; black steel pipe. Steel pipe shall be joined by means of flanges welded or screwed to the pipe, threaded fittings, or grooved couplings only. Piping shall not be joined by welding or weld fittings.
2. Thinwall Pipe: Schedule 10 Pipe meeting ASTM A-53, A-135 or A-795 requirements with grooved pipe couplings and fittings. Grooves in Schedule 10 pipe shall be rolled groove only. Pipe having wall thicknesses less than Schedule 10 are unacceptable.

B. Piping Sizes 2 inches (50 mm) and Smaller

1. Steel Pipe: Steel piping shall be ASTM A-53/A-135/A-795, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A, steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, cast or ductile iron threaded fittings. Unions shall be ASME B16.39, Class 150, unions. Pipe may also be joined using grooved couplings and fittings. Where grooved joining is used, cut or rolled grooves are acceptable.
2. Post-chlorinated Poly Vinyl Chloride (CPVC) shall not be acceptable.

C. Pipe Hangers and Supports

1. Pipe hangers and supports shall be UL listed, FM approved, and California State Fire Marshal approved, and shall be the adjustable type. Installation shall be according to the manufacturers' listing.
2. Seismic hangers and bracing shall be UL listed, FM approved, and California State Fire Marshal approved for fire protection use and shall be installed in accordance with their listings and manufacturers' recommendations. Type, quantity, and spacing shall be in accordance with the requirements for the specific seismic zone requirements and those of NFPA.

2.4 CONTROL AND DRAIN VALVES

A. Sprinkler system control and drain valves shall be the following types:

1. O.S&Y. gate valves.
2. Post indicator valves shall be direct buried, made of cast iron body, resilient wedge construction, fusion epoxy lined and coated, non-rising stem with cast iron body, adjustable type and conforming to AWWA specifications. Post indicator shall be cast iron body, adjustable type and include non-breakable plastic windows to indicate the valve position. Post indicator valves shall have operating wrench attached to the post indicator. Valves are to be locked in the open position.
3. Butterfly valves with gear operator assembly and open/closed position indicator. Butterfly valves shall have an integrated, factory-installed supervisory (tamper) switch.
4. Brass seated, straight-way or angle globe valves for main drain and inspector's test. System Gauges shall be riser mounted to ¼ inch, three-way globe valves.
5. Riser check valve: A riser check valve shall be provided on the building water supply riser, prior to the fire department connection. The riser check valve shall have a cast iron body and shall be of the "swing check" type/style. Wafer type check valves will not be permitted.

B. All valves must be UL listed, FM approved, California State Fire Marshal approved for their intended use.

C. Signs: All water supply control valves and drain valves shall be marked with metal signs and shall be secured with metal chains or other means approved by Owner and AHJ to show their function and sprinkler system zone which they serve. Attachment of signs to the valves with adhesives is not permitted.

D. Pressure Ratings: Pressure ratings of all valves shall meet or exceed maximum working pressures available within the system.

E. Supervision: All system control valves shall be capable of being locked in the open position. System control valves shall be equipped with electronic supervisory (tamper) switch having two normally open contacts (rated for 24vdc service). and shall be electrically supervised by the building fire alarm system.

F. Access Panels: Furnish and install access panels (minimum size 12-inches by 12-inches) for all control valves located above finished ceilings or concealed in walls. Owner will select finish of access panels. Access panels installed in fire resistive construction shall be of the types required for maintaining proper protection of assembly.

G. Valves and assemblies that are exposed to potential damage by vehicles or other traffic are to be protected by providing a cage or other approved barrier when located inside the building.

2.5 ELECTRICAL WORK

A. Furnish all labor, equipment and services necessary for the design and installation of required connections as required to complete fully operational system(s). Contractor will be responsible for the mounting of all water flow, tamper, and pressure switches for the fire protection systems in this Section. Wiring of such devices is outside the scope of this specification. Wiring of such devices is included in the Alarm and Detection specification and is the responsibility of the A&D contractor.

B. Service. Confirm power connections with electrical contractor.

C. Testing. Provide the required assistance to the Alarm and Detection Contractor to test, adjust and place the fire protection system(s) into initial operation.

2.6 SPRINKLERS

A. Contractor shall furnish and install fire sprinklers of the following types and finishes:

1. Semi-recessed Quick-Response (QR) pendent sprinklers shall be installed in all areas with ceiling. Recessed sprinklers shall be a UL listed or FM approved assembly, and the escutcheon shall be integral to the sprinkler. Finish shall be white escutcheon with white polyester sprinkler unless otherwise directed by the Owner/Architect in the submittal process.
2. Standard upright or pendent sprinklers shall be installed in non-public, unfinished areas. Sprinkler finish shall be white polyester, unless otherwise directed by the Owner/Architect in the submittal process.
3. Standard temperature upright, or pendent with cage guards, shall be installed in areas subject to damage (e.g., under stairs and mechanical rooms). Fusible link style sprinklers shall be acceptable in areas subject to damage. Sprinkler finish in such areas shall be brass, unless otherwise directed by the Owner/Architect in the submittal process.

B. Final Selection: Owner will select finishes for all automatic sprinklers and escutcheons.

C. Uniformity: All sprinklers within a space shall be from the same manufacturer and shall have the same type and style of heat response element, including temperature rating and response characteristics.

D. Temperature Rating: It shall be Contractor's responsibility to install sprinklers of the proper temperature rating as required by NFPA 13.

E. Corrosion Resistance: Sprinklers located on exterior piping systems or in areas exposed to corrosive atmospheres shall be UL listed and/or FM approved corrosion resistant coated or stainless steel.

F. Sprinkler Escutcheons: Flush sprinkler escutcheons shall be metal and shall be listed for use with the sprinklers. Recessed sprinklers and escutcheons shall be UL listed and/or FM approved as an assembly, and the sprinkler and escutcheon shall be of the same manufacturer.

G. Sprinkler Orifice: Sprinkler orifice sizes shall be confirmed through hydraulic calculations for the system(s). Sprinklers having a nominal 'K' factor of less than 5.6 are not acceptable unless specifically allowed by NFPA 13. The orifice size shall be uniform within a protected area.

H. All sprinklers in finished areas shall be center of tile plus or minus 2 inches, unless approved by the Owner. All sprinklers shall be aligned in all directions when multiple sprinklers are in the same area and are in the same line of sight. Contractor shall coordinate location of all sprinklers in finished areas with architect and Owner.

I. Where acceptable to AHJ, the use of flexible drops is **preferred and requested** by the Owner and Architect, but all such drops must be installed in accordance with their UL listings and/or FM approvals. Where such listings/approvals differ, the most stringent installation requirements will apply. The use of flexible drops shall be accounted for in all hydraulic calculations for the system(s). Flexible drops shall be of the braided, stainless steel hose style. Flexible drops employing corrugated steel tubing will not be permitted.

2.7 IDENTIFICATION SIGNS

A. Contractor shall furnish and install hydraulic calculation signs for each new sprinkler zone. Hydraulic calculation signs shall be affixed to the corresponding system riser downstream of the system control valve and main drain at the riser. Contractor shall also provide identification signs for all valves installed under this section.

B. Hydraulic calculation signs shall include all information indicated in NFPA 13 and its appendices. Valve identification signs shall identify the function of the valve and the area served.

C. Conspicuous identification signs shall be provided at each standpipe hose connection as required by NFPA 14.

D. Identification signs shall be rigid, metal plaques with embossed enamel background and lettering. Signs shall be secured by chain or durable wire to each sprinkler zone control valve, main and auxiliary drain, and inspector's test valve. System hydraulic calculation placards affixed using adhesives, and/or using permanent marker for information, are NOT acceptable.

2.8 FIRE DEPARTMENT CONNECTION, STANDPIPE AND HOSE EQUIPMENT

A. Standpipe Hose Valves: Standpipe hose valves shall be suitable for Class I standpipe service as defined by NFPA 14. Standpipes shall be equipped with a 2-1/2 inch brass hose valve(s) at the floor level of each stairwell and on the roof level. The 2-1/2 inch hose valve(s) shall be brass bodied, angle style, and shall be female inlet x male hose thread outlet. The 2-1/2 inch inlet threats shall be NPT, and the male hose threads shall match the requirements of the local fire department. Hose valves shall be mounted approximately 48 inches above each stairwell floor level. Valve bodies shall be cast brass, and shall be rated for 300 psi service. The finish of the valves shall be brass or polished chrome and approved by the local fire department and the Owner. All standpipe hose valves shall be UL listed and/or FM approved for their intended service, and valves shall be of a single manufacturer. The valves and hose threads shall be acceptable to the local AHJ. The standpipe hose valve shall be Zurn/Wilkins Model Z3000 or equivalent of the same size and dimensions. Hose connections to be provided within enclosure/cabinet where indicated by Architect and/or Owner.

B. Hose Cabinets and equipment: The contractor shall coordinate the location and size of any and all equipment selected with the Owner prior to installation. Hose cabinets shall be conspicuously identified as required by NFPA 14.

2.9 SUPERVISORY AND ALARM EQUIPMENT

A. All waterflow and valve supervisory switches shall be furnished, installed and properly adjusted by the sprinkler contractor. Alarm monitoring of these devices will be by others.

B. Contacts: All waterflow and valve supervisory switches shall be provided with two "Form C" (D.P.D.T.) contacts for monitoring. Specific contact rating shall be coordinated with the fire alarm contractor.

C. Waterflow Switches: Vane-type and/or pressure-type water flow indicators shall be provided to indicate waterflow in each sprinkler system zone and shall by UL listed and/or FM approved. All water flow switches shall be equipped with an adjustable retard setting that can be varied from 0 to 60 (minimum) seconds.

D. Supervisory Switches: Valve supervisory (tamper) switches shall be provided for all valves controlling the water supply to the sprinkler systems. Valve supervisory switches for OS&Y type valves shall be the yoke mounted or integral type. Supervisory switches for butterfly style valves shall be factory installed and integral to the valve assembly.

E. Loop Type Valve Supervisory Switches: Contractor shall not use wire loop type switches.

2.10 INSPECTOR'S TEST AND DRAIN ASSEMBLY(S)

A. For multiple level installations, an inspector's test and drain assembly(s) shall be provided at each floor connection to a riser for the wet-pipe system(s). This test and drain assembly may be a modular unit type.

B. For applications other than that specified in 2.11A, an inspector's test and drain assembly shall be provided at the most hydraulically remote part of the wet-pipe system and shall discharge to a location approved by the Owner. The inspector's test piping arrangement for wet system(s) shall be in compliance with the requirements of NFPA 13.

C. Inspector's test and drain assemblies shall comply with the requirements of NFPA 13. All components of test and drain assemblies shall be UL listed and/or FM approved.

2.11 STANDPIPE DRAIN RISER

A. Three (3) inch drain risers shall be provided adjacent to each standpipe as required by NFPA 14 to facilitate testing of the pressure regulating hose valves. The drain risers shall be provided with a 3-inch by 2½-inch tee with a plug and shall be located on at least every other floor. Location of the drain plugs and drain discharge shall be approved by the Owner.

2.12 MISCELLANEOUS PRODUCTS

A. Pressure Gauges: Pressure gauges shall be UL listed 3-1/2-inch minimum diameter, dial type gauges with a maximum limit of not less than twice the normal working pressure at the point installed. All gauges shall be provided with ¼ inch, 3-way shut-off valve (gauge-cock).

PART 3 - EXECUTION

3.1 WORKING CONDITIONS

A. Contractor shall visit the site and become familiar with the conditions under which the work will be performed.

B. Contractor's installation shall be performed in accordance with the project's master specification and/or Owner direction. Contractor will have site access during working hours.

3.2 PREPARATION FOR WORK

A. Cooperation with other trades: Contractor shall coordinate with the work of the other trades towards the general purpose of having the construction progress as rapidly and as smoothly as possible with a minimum of interference between trades.

B. Before the start of Structural Work, Contractor shall submit to Owner locations, sizes, and instructions for openings and penetrations required for his work. Submittal and proposed penetrations shall be subject to Owner's approval. Contractor shall provide any additional penetrations or openings or relocation required, that were not addressed in their initial submittal at no additional cost to Owner.

C. Approval prior to installation: No work shall commence prior to approval of shop drawings by the approving authorities, including Owner. Any change in work that has been installed prior to approval of the shop drawings shall be made without additional compensation to Contractor.

3.3 GENERAL INSTALLATION

A. Aesthetics shall be a primary consideration when installing sprinklers and sprinkler piping in all areas. Any facet of sprinkler installation that deviates from the approved shop drawings and does not meet with Owner's approval shall be revised by Contractor to Owner's satisfaction at no additional cost.

B. All holes made by Contractor in any wall, ceiling, or floor shall be patched by Contractor, restoring the wall, ceiling, floor or member to its intended condition, fire resistance, and integrity.

C. Location of all equipment, controls, piping, valves and drains shall be subject to Owner's approval.

D. All sprinklers and equipment shall be installed in accordance with manufacturers' instructions. All special tools, including sprinkler wrenches, recommended by the manufacturer shall be used.

E. Sprinklers shall be installed with the deflector to ceiling distances in accordance with their UL listings and/or FM approval and the requirements of NFPA 13.

3.4 PIPING

A. All sprinkler piping installed in public areas or non-public areas with suspended ceilings shall be concealed in the walls, ceilings or soffits. Pipe in unfinished areas may be exposed.

B. All piping exposed within the building public areas shall be painted with one coat by Contractor. Owner is to select the colors. All exterior piping shall be primed with zinc chromate and painted by Contractor.

C. Escutcheon Plates: All exposed pipe which passes through a wall, ceiling, or floor shall be provided with metal escutcheon plates.

D. Minimum Height: All exposed piping and devices shall be installed as high as possible, but no less than seven (7) feet clear above the finished floor in traffic or working areas, so as not to obstruct any portion of a window, doorway, stairway or passageway. Pipe and fittings shall not interfere with the operation or accessibility of any mechanical, plumbing or electrical equipment.

E. Operating Chains: Valves controlling water supply to the sprinkler systems shall be less than seven (7) feet above the finished floor. When specifically approved by Owner, they may be higher and must be provided with operating chains.

F. Protection: Contractor shall provide Owner approved, adequate permanent protection for any installed piping, valves, devices or accessories which, in Owner's opinion, are subject to physical damage or may be hazards.

G. Firestopping: Pipe that passes through fire-rated resistive barriers (including shaft walls) shall be sleeved and grouted or sealed with a UL-listed through-penetration fire stop system to maintain the integrity and rating of the fire resistive barrier.

H. Testing: All piping is to be flushed and hydraulically tested prior to acceptance by owner. Flushing and testing must be performed in accordance with NFPA standards.

I. Contractor shall provide all equipment necessary for testing and flushing and any special equipment required for the installation of any portion sprinkler (and/or standpipe) system(s). Contractor shall remove all such equipment at the end of the job.

J. All above ground piping 2-1/2" and larger shall be provided with labels at 20-foot intervals indicating sprinkler system piping.

3.5 SYSTEM TEST AND DRAIN CONNECTIONS

A. Contractor shall provide all test valves and drain connections as required by NFPA 13.

B. All test connections and drain riser connections shall be hard piped to discharge waste water to the floor drain within the Fire Riser Room, or as required by the AHJ. When acceptable to Owner, drain piping may terminate at an interior drain of sufficient size and capacity to accommodate the anticipated maximum flow. The sprinkler contractor shall coordinate routing of the drain pipe and points of discharge.

3.6 STANDPIPE DRAIN RISER CONNECTIONS

A. Contractor shall provide all standpipe drain riser connections as required by NFPA 14.

B. All drain riser connections shall be hard piped to discharge waste water to the floor drain within the Fire Riser Room, or as required by the AHJ. When acceptable to Owner, drain piping may terminate at an interior drain of sufficient size and capacity to accommodate the anticipated maximum flow. The sprinkler contractor shall coordinate routing of the drain pipe and points of discharge.

3.7 RISERS

A. Contractor shall locate the main risers for the sprinkler system to minimize obstruction to traffic or building operations. Exact location of risers shall be approved by Owner.

B. Zoning: The fire sprinkler system shall be zoned on a per floor basis and divided into zones as noted herein (and/or on the riser diagram shown on the contract drawings). Sprinkler zones shall not exceed the maximum area per zone specified in NFPA 13. Sprinkler zoning (and alarms) will also conform to alarm and detection and smoke control system zoning.

C. Supervisory Switches: Valve supervisory switches shall be provided on all valves controlling water supply to the fire sprinkler system, including valves located at backflow preventers.

3.8 FLUSHING AND SANITIZATION

A. All equipment and materials prior to installation shall be clean inside and outside. All waste material such as chips, filings, welding stubs, dirt, rags, debris, and any other foreign material shall be removed from the components before assembly.

B. All steel pipe coupons or punched holes for welded or mechanical outlets shall be attached to the pipe near the pipe hole. Protective plastic caps shall be located over openings and pipe ends during installation to prevent foreign material from entering the pipe at any time.

3.9 SEISMIC CONSIDERATIONS

A. Sprinkler piping on any floor level may cross building structural separations such as expansion and seismic joints, provided that the piping is specifically designed with flexible connections at each crossing and able to accommodate the calculated differential motions during an earthquake, but not less than a minimum of 24 inches. All required structural, differential movement and drift calculations shall be prepared by a licensed structural engineer possessing current California registration. (Contractor shall verify locations of seismic joints.)

3.10 SWAY BRACING, FLEXIBLE COUPLINGS, HANGERS

A. All flexible couplings, hangers and sway bracing shall be designed and installed as required by NFPA 13 (including all appendices) and in accordance with their listings and/or approvals. Flexibility, internal pressure, and differential movement between the piping and building, earth, or other supporting structure(s) shall be allowed for, so that no allowable stress is exceeded in any member.

3.11 TRAINING

A. Contractor shall conduct two (2) training sessions of four (4) hours each at the project site to familiarize the building personnel with the features, operation and maintenance of the sprinklers. Training sessions shall be scheduled by Owner at a time mutually agreeable to Contractor and Owner.

B. Agenda: Contractor shall submit a proposed training agenda for Owner's review and approval within 60 days of receipt of authorization to proceed. The proposed training agenda shall include, but not be limited to, the following:

1. Overview of system operation.
2. Overview of system equipment and device locations.
3. Detailed operation guidelines.
4. Detailed maintenance procedures.
5. Periodic testing procedures.

C. Final Agenda: Contractor shall submit the final approved training agenda 14 days prior to the first training session.

3.12 FINAL INSPECTION AND TEST

A. Contractor shall make arrangements with Owner for Owner’s final inspection and witnessing of the final acceptance tests. This test shall be separate from testing by the local authorities.

B. All tests and inspections required by the referenced Codes and Standards, AHJ, and Owner shall be conducted by Contractor under this scope of work.

1. When AHJ are required to witness tests, Contractor shall be responsible for making all necessary arrangements with the code authorities and coordinating the testing with Owner.
2. Contractor shall be responsible for completing all test documents with necessary approval stamps and signatures of the AHJ. Contractor shall submit one copy of each of these documents to Owner for their records.

C. Acceptance Testing: Upon completion of each system, perform and document on an NFPA or approved format, system tests as described herein. All acceptance tests shall be performed in the presence of Owner.

1. Hydrostatic tests.
2. Flushing of piping.
3. Test of sprinkler supervisory system – The Alarm and Detection Contractor should be present at the testing of all sprinkler alarm and supervisory devices. This Contractor shall coordinate the final testing of all such devices with the Alarm and Detection Contractor.
4. Contractor to provide NFPA testing certificate to the Owner, the local fire authority, the project architect, and DSA.

D. Contractor shall provide at least five (5) working days’ notice for all tests to all involved.

3.13 FINAL APPROVAL

A. Final approval and acceptance of the work will be given by Owner when:

1. The completed sprinkler system(s) has (have) been inspected, tested and approved by Owner and AHJ.
2. Required submittals, system operation and maintenance manuals, record drawings, spare parts, special tools and training have been provided to, reviewed, and accepted by Owner.

3. Written certification is submitted that states all equipment has been inspected and tested by a manufacturer's certified representative.
4. Written certification is submitted that states all equipment is installed in accordance with the manufacturer's recommendations and UL and/or FM approvals.

B. Owner's Representative may visit the job site to observe the work and witness the final acceptance tests when advised by Contractor that the work is complete and ready for test. If the work has not been completed, or the test is unsatisfactory, Contractor shall be responsible for Owner's added expenses for re-inspection and witnessing the retesting of the work. Such extra fees shall be deducted from payments by Owner to Contractor.

C. Additional Tests: Any additional tests, required by the referenced codes, standards, or criteria, or by Owner, shall be performed. This documentation shall include:
1. The date and time of each test.
2. A reference set of contractor record drawings, numerically identifying the individual components and circuits tested, and test locations.
3. A description of each test performed.
4. A checklist of each device tested, indicating the results of each test.
5. The names and signatures of the individuals conducting and witnessing each test.

3.14 FIELD QUALITY CONTROL

A. Scheduling of Work
1. Coordinate the installation schedule for this portion of the work with the overall construction schedule for the project to ensure orderly progress of the work without delay.
2. Coordinate the interface of the automatic sprinkler system with the work of all other trades as well as new construction to ensure proper and adequate provision for the installation and connection of this system.

3.15 HOUSEKEEPING

1. Upon completion of the work the Contractor will completely remove all debris and excess materials from the job site.

3.16 GUARANTEE PERIOD

A. Except as otherwise expressly provided in the Contract Documents, and excepting only items of routine maintenance, ordinary wear and tear or unusual abuse or neglect, Contractor guarantees all work executed by Contractor and all supplies, materials and devices of whatsoever nature incorporated in, or attached with the work, or otherwise delivered to the Owner as part of the work pursuant to the contract to be absolutely free of all defects of workmanship and materials for a period of ~~one year~~ two years ***ADD-3*** after final acceptance of the work by Owner's Representative.
1. Include service directory with telephone numbers for 24-hour emergency service.

END OF SECTION

SECTION 220500
COMMON WORK RESULTS FOR PLUMBING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of this Section shall apply to the entire Division 22 work, and Section 23 1123 – FACILITY NATURAL GAS PIPING.

B. All referenced and related provisions of Divisions 21, 23 and Division 26 shall also apply to the work of this Section as if fully repeated herein.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 01 8113 of this Specifications Manual.

D. Refer to General Commissioning Requirements on Section 019113.

1.2 WORK OF THIS SECTION

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, 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.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. PE: Polyethylene plastic.
2. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-dieneterpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style, and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Regulatory Requirements
   1. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
   2. UL Compliance: Construct water coolers in accordance with UL 399, and furnish UL listing and label.
   3. ASHRAE Compliance: Test and rate water coolers in accordance with ASHRAE 18.
   4. ANSI Standards: Comply with applicable ANSI barrier-free plumbing fixture standards.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery plumbing fixtures individually wrapped in factory-fabricated containers.

B. Handle plumbing fixtures carefully to prevent breakage, chipping, and scoring fixture finish. Do not install damaged plumbing fixtures; replace damaged units

C. 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.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION WITHIN DIVISION 22

A. Contract Documents
   1. General: The contract documents are diagrammatic showing certain physical relationships, which must be established within Division 22 work and its interface with other work. Such establishment is the exclusive responsibility of the Contractor.
   2. Drawings shall not be scaled for the purpose of establishing dimensions, clearances or material quantities.
   3. Supplemental Instructions: The exact location for some items in this specification may not be shown on the Drawings. The location of such items may be established by the Owner Representative during the progress of the work.
   4. Discrepancies
      a. Examine drawings and specifications of all Divisions of the work.
      b. Report any discrepancies to the Owner’s Representative and obtain written instructions before proceeding.

B. Contractor shall be responsible to furnish proper documentation of equipment product data and shop drawings to all entities providing services.

C. Coordination Drawings: Prepare coordination drawings in accordance with Section 01 3323 – SHOP DRAWINGS, PRODUCT DATA & SAMPLES to scale of 1/8” = 1”-0” or larger for floor plans, and 1/4” = 1’-0” for equipment rooms and restrooms, detailing major elements, components, and systems mechanical equipment (i.e. equipment rooms, and exterior equipment areas) and materials in relationship with other system, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important to the efficient flow of the work, including (but not necessarily limited to) the following:

1. Indicate all major piping (HVAC, Plumbing and Fire Protection), electrical equipment and conduits, structural, and architectural elements in the areas as well.
2. Sizes and locations of required concrete pads, piers, curbs and bases.
3. Furnish all necessary sections and elements for clarification.
4. Indicate all seismic restraint and support systems to be used for all plumbing equipment throughout the project.
5. Ductwork and piping transitions from rooftop units to shafts or horizontal ducts.
6. Failure to produce or submit coordination drawings does not dismiss the Contractor's responsibility for translating the design intent of the contract documents into construction drawings.

D. Utility Connections
1. Coordinate the connection of plumbing systems with utilities and services.
2. Comply with regulations of utility suppliers.
3. The contract documents indicate the available information on existing utilities and services, and on new services (if any) to be provided to the project by utility companies and agencies.
   a. Notify the Owner's Representative immediately if discrepancies are found.
4. Refer to Section 01 1400, WORK RESTRICTIONS, for utility shut-down requirements.

E. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

F. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

G. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Section 08 3113 – ACCESS PANELS AND FRAMES.

1.7 COORDINATION WITH OTHER DIVISIONS

A. General
1. Coordinate the Division 22 work.
2. Contractor is responsible for coordination of his / her work with building automation, commissioning of systems, fire alarm system, etc.

B. Coordination with Electrical work: Refer to Section 26 0500 – COMMON WORK RESULTS FOR ELECTRICAl.

C. Cutting and patching: Refer to Section 01 7329 – CUTTING AND PATCHING for general demolition requirements and procedures.

D. Support Dimensions: Furnish dimensions and drawings so that concrete bases and other equipment supports to be provided under other sections of the specifications can be built at the proper time.

1.8 ENGINEERING BY CONTRACTOR

A. The construction of this building requires the Contractor to design several systems or sub systems. All such designs shall the complete responsibility of the Contractor.

B. Systems or sub-systems which require responsibility by the Contractor and submitted to the Owner's Representative for review include, but are not limited to:
1. Equipment and piping supports.
2. Pipe hangers and anchors not specified in these documents, or cataloged by the manufacturer.
3. Vibration Isolation / Seismic Restraint.
4. Underground piping distribution systems.
5. Thermal pipe stress analysis

1.9 REGULATORY REQUIREMENTS

A. Refer to Section 01 4100, REGULATORY REQUIREMENTS.

B. Additional Regulations: Follow additional regulations which appear in individual sections of these specifications.

C. Inspections and Tests
   1. Arrange for all required inspections and tests.
   2. Notify the Owner's Representative in writing 72 hours before tests.
   3. Submit three copies for Owner's Representative record licenses, inspection reports and test reports.

1.10 SUBSTITUTIONS

A. Refer to Section 01 2513, PRODUCT SUBSTITUTION PROCEDURES.

1.11 GENERAL SUBMITTAL REQUIREMENTS

A. Refer to Division 01.

B. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 01 8113 of this Specifications Manual. Furnish submittals as required in Section 01 8113-1.4 for all relevant materials in this section.

C. Submittals: Contractor shall submit proof of qualifications.

D. Coordination and Sequencing
   1. Plumbing products requiring approval by the State of California Dept. of Industry, Labor and Human Relations must be approved or have pending approval at the time of shop drawing submission.
   2. Welding certificates and requirements.
   3. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
   4. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   5. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   6. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
   7. Coordinate submittals 3 weeks (minimum) prior to expected order date so that work will not be delayed by submittals.
   8. Do not submit product data, or allow its use on the project until compliance, with requirements of Contracted Documents has been confirmed by Contractor.
   9. Submittal is for information and record, unless otherwise indicated, and is not a change order request.
   10. Make submittals for group of similar products or materials such as valves, fixtures, pumps, insulation, etc., or area or work complete and at one time, not in piecemeal fashion.

E. Preparations of Submittals
   1. Refer to Division 01 requirements.
   2. Furnish permanent marking on each submittal to identify project, date, Contractor, SubContractor, Supplier, submittal name and similar information to distinguish it from other submittals.
   3. Show Contractor's executed review and approval markings.

F. Quantities: Unless otherwise indicated in Division 01, submit six copies.
   1. Refer to Division 01 requirements.
   2. Multiple Systems Items: Where a required submittal relates to an operational item of equipment used in more than one system, increase the number of final copies as necessary to complete the Maintenance Manuals for each system.
   3. General Distribution:
      a. Furnish additional distribution of submittals (not included in Division 1) to SubContractors, suppliers, fabricators, installers, governing authorities and others as necessary for proper performance of the work.

b. Include such additional copies in transmittal to Owner's Representative where required to receive "Action" marking before final distribution.
c. Show such distributions on transmittal forms.

G. Record Drawings ("as-builts") are extremely important to the ongoing operation of the facility, but are often neglected in the crisis of construction. The engineer and inspector should verify at each site visit that the contractor is maintaining adequate as-builts, and should obtain progress copies of the contractor's as-builts during construction. At the completion of the project, it is too late to verify concealed work and documents are often misplaced.

1.12 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS

A. Manufacturer's Data
1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black ink to indicate which of the variations is to be furnished.
2. Delete or mark out significant portions of pre-printed data, which are not applicable.
3. Where operating ranges are shown, mark data to show portion of range required for project application.
4. For each product, include the following:
a. Sizes.
b. Dimensions.
c. Weights.
d. Speeds.
e. Capacities.
f. Fixture Color.
g. Cabinet Finish.
h. Piping and Electrical connection sizes and locations.
i. Statements of compliance with the required standards and regulations.
j. Performance data.
k. Manufacturer's specifications and installation instructions.

B. Shop Drawings: Prepare Plumbing Shop Drawings, except diagrams, to accurate scale.
1. Show clearance dimensions at critical locations.
2. Show dimensions of spaces required for operation and maintenance.
3. Show interfaces with other work including structural support.

C. Test Reports
1. Submit test reports, which have been signed and dated by the firm performing the test.
2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.

D. Required Equipment and Shop Drawing Submittals
1. Furnish equipment submittals for each item of equipment specified of scheduled in the Contract Documents.
2. Submittal schedule shall show each item of equipment, applicable section of the specifications where it is described, applicable drawing number and schedule name where it is scheduled, date of Contractors proposed submittal to the Owner's Representative and schedule order date.
3. Furnish a plumbing shop drawing schedule for submission to the Owner's Representative with the submittal schedule.

1.13 CAPABILITY

A. General: Provide products, which are compatible with other products of the plumbing work, and with other work, requiring interface with the plumbing work.

B. Power Characteristics: Where power requirements are not stated in Division 22 Sections, refer to Sections of Division 26 and the electrical drawings for the power characteristics of each power driven item of plumbing equipment. Coordinate available power with Division 23 before ordering equipment. Order equipment to meet the available power characteristics. If there is a conflict between Division 22 documents and Division 26 documents, furnish a written notification to the Owner's Representative for direction. Do not order equipment prior to determining the proper electrical service. No contract cost adjustment will be allowed for equipment ordered in conflict with the available power characteristics.

1.14 AS-BUILT DRAWINGS

A. Drawings
   1. Refer to Section 01 78 39, Project Record Documents.
   2. Include in Record Drawings the Following
      a. Revisions, including sketches, bulletins, change orders, written addenda and directives, clarifications and responses generated by requests for information (RFI's), regardless of source of the revision.
      b. Location and configuration of equipment with related housekeeping pads.
      c. Location of fixtures, drains and appurtenances.
      d. Physical routing of piping, underground, exposed, and above ceiling with locations of valves and accessories plainly marked and identified.
      e. Location of piping below building and exterior, valves, manholes, appurtenances and stub outs dimensioned from buildings and permanent structures, both horizontally and vertically.
      f. Location of wall and ceiling access panels.

1.15 OPERATION AND MAINTENACE DATA

A. Refer to General Conditions.

B. Submission
   1. Submit three typed and bound copies or Operating and Maintenance (O&M) Manuals for each type of fixture and piece of equipment prior to scheduling systems demonstrations for the Owner's Representative.
   2. Bind each Maintenance Manual in one or more vinyl covered, 3-ring binders, with pockets for folded drawings.
   3. Mark the spine of each binder with system identification and volume number.

C. Required Contents
   1. Manuals shall have index with tab dividers for each major equipment section to facilitate locating information on a specific piece of equipment.
   2. Identify data within each section with drawing code numbers as they appear on drawings and specifications. Include as a minimum the following data:
      a. Alphabetical list of system components, with the name, address and 24-hour telephone number of the company responsible for servicing each item during the first year or operation. Include point of contact for company.
      b. Operating instructions for complete system including:
         1) Emergency procedures for fire and failure of major equipment.
         2) Major start, operation and shut down procedures.
      c. Maintenance instructions for each piece of equipment including:
         1) Equipment lists.
         2) Proper lubricants and lubricating instructions for each piece of equipment.
         3) Necessary cleaning, replacement and/or adjustment schedule.
         4) Product data.
         5) Installation instructions.
         6) Parts list.
      d. Marked or changed prints locating concealed parts and variations from the original system design (As-built drawings).
      e. Valve schedule and associated piping schematics, see Section 22 0553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT.
      f. Copies of any extended equipment warranties which are greater than one year.

1.16 WARRANTIES

A. The warranty period shall be no less than two (2) full years, unless specified otherwise hereinafter .

B. During the warranty period, the contractor shall guarantee the following in a form satisfactory to the Owner:

1. All Work installed will be free from any and all defects in Workmanship and/or materials.
2. All equipment, apparatus will develop capacities and performance characteristics specified .
3. The systems shall operate without malfunction .

C. The contractor shall, without cost to the Owner, remedy any defects within a reasonable time to be specified in notice from the Architect. In default thereof, the Owner may have such Work done and charge all costs to the Subcontractor.

D. The start of the contractor's warranty period, as defined in the General Conditions, shall commence on the issue of a "Certificate of ~~Substantial~~ Final Completion", by the Owner or the Owner's Representative for each item of material, equipment or system. **ADD-3**

E. The contractor shall confer prior to the bid date concerning the Schedule and determine if there is a need to operate any items of equipment or systems for temporary heating and/or cooling or other reasons prior to substantial completion. All required extended warranty costs for equipment, materials and systems shall be included in the contractor's proposal.

1.17 SPARE PARTS, SPECIAL TOOLS

A. Deliver spare parts to the Owner's Representative and obtain receipts at the time operating instructions are given to Owner's Representative personnel.

B. Include the following:

1. V-belts: One complete set of each size.
2. Fuses: Each type used for all equipment utilizing fuses. Quantity 10 percent, but not less than two.
3. Pilot light lamps: each type used on the project. Quantity 10 percent, but not less than two.
4. Special Tools: Furnish special tools required for assembly, adjustment, setting or maintenance of equipment if such tool is not readily available on the commercial tool market.
5. Maintenance Paint: Furnish one can of touch up paint for each different factory finish, which is to be the final finished surface of the product.

1.18 SYSTEM ACCEPTANCE

A. Acceptance shall be contingent upon completion of final review and correction of all deficiencies. Satisfactory completion of the operational tests, which shall demonstrate compliance with all performance criteria, and the requirements of the contract documents.

B. Request a final review prior to system acceptance after completion of the following:

1. Installation of all systems required by contract documents.
2. Submission and acceptance service manuals.
3. Identification.
4. Cleaning.
5. Satisfactory operation of all systems for a period of one week.

1.19 OWNER FURNISHED / CONTRACTOR INSTALLED EQUPMENT

A. All equipment called out in the specifications or shown on the drawings as "Owner Furnished/ Contractor Installed" shall be installed and connected under this contract. Provide rough-ins for all future connections indicated unless otherwise specifically indicated on drawings.

1.20 TEMPORARY FACILITIES

A. Light, heat, power, etc.

1. Contractor shall be responsible for providing temporary electricity, heat and other facilities as specified in Division 01.

1.21 SAFETY PROVISIONS

A. Equipment Nameplates: Provide power oriented plumbing equipment with a permanent nameplate attached by the manufacturer, indicating:
   1. The manufacturer.
   2. Product name.
   3. Model number.
   4. Serial number.
   5. Speed.
   6. Capacity.
   7. Power characteristics.
   8. Labels of testing, or inspecting agencies.
   9. Other similar data.

B. Where manufacturer affixed nameplate is not available, Contractor shall fabricate and attach nameplate.

C. Guards
   1. Unless equivalent guards are provided integral with the equipment, enclose each belt drive (including sheaves) on both sides in a galvanized, one inch, mesh screen of No. 18 gage steel wire or expanded metal, fastened to an approved, structure steel frame, securely fastened to the equipment or floor.
   2. Provide tachometer holes at shaft centers. Unless equivalent guards are provided integral with the equipment, install a solid guard of No. 20 gage galvanized steel over the coupling of each item of direct driven equipment.
   3. Sides are not required on these guards except to ensure rigidity.

1.22 LEAD FREE PRODUCTS FOR INSTALLATION

A. On January 1, 2010 Assembly Bill AB-1953 became law which calls for the installation of lead free products in plumbing systems.

B. The Contractor shall install products that comply with the requirements as described in State Assembly Bill AB-1953.

C. Submit all lead free products to be installed to the Owner's Representative for review.

1.23 TRAINING OF OWNER'S PERSONNEL

A. Confirm training requirements listed below with the Owner.

B. Furnish the Owner's designated personnel with five 8-hour days of training and instruction. The training and instruction sessions shall be conducted at the Owner's convenience.

C. All training of personnel shall be completed before final inspection.

D. All training shall be conducted within the project boundaries. If this is not possible, all the costs associated with travel, room and board of the Owner's Personnel selected to attend the training session shall be at no additional cost to the Owner.

E. All training shall be videotaped and submitted to Owner for their record.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. If no manufacturer is listed, "Basis of Design" is industry standard indicated.

B. Provide all plumbing fixtures complete with all necessary trim and accessories to insure the specified complete installation and operation of each fixture. Include trim and accessories, not to be limited to, rigid brass, supply pipes, stops, drains, strainers, tailpieces, P-traps, escutcheon plates and bolt caps.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8-inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers
    a. Cascade Waterworks Mfg. Co.
    b. Dresser Industries, Inc.; DMD Div.
    c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    d. JCM Industries.
    e. Smith-Blair, Inc.
    f. Viking Johnson.
    g. Or equal
2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers
    a. Eslon Thermoplastics.
    b. Or equal.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers
    a. Thompson Plastics, Inc.

b. Or equal.

D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
   1. Manufacturers
      a. NIBCO, Inc.; Chemtrol Div.
      b. Or equal.

E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.
   1. Manufacturers
      a. Cascade Waterworks Mfg. Co.
      b. Fernco, Inc.
      c. Mission Rubber Company.
      d. Plastic Oddities, Inc.
      e. Or equal.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum working pressure as required to suit system pressures.
   1. Manufacturers
      a. Epco Sales, Inc.
      b. Watts Industries, Inc.; Water Products Div.
      c. Zurn Industries, Inc.; Wilkins Div.
      d. Or equal.

D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Manufacturers
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Central Plastics Company.
      d. Pipeline Seal and Insulator, Inc.
      e. Or equal.
   2. Separate companion flanges and steel bolts and nuts shall have 150 or 300 psig minimum working pressure where required to suit system pressures.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Manufacturers
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
      e. Or equal.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Under deck Clamp: Clamping ring with set screws.
   2. Manufacturers
      a. Zurn Industries.
      b. JR Smith.
      c. Or equal.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw and polished chrome-plated finish.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw and polished chrome-plated finish.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, non shrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000 psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.10 WALL PENETRATION SYSTEMS

A. Manufacturers:
   1. SIGMA.
   2. ProSet.
   3. Or equal.

B. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.
   1. Carrier-Pipe Deflection: Up to 5 percent without leakage.
   2. Housing: Ductile-iron casting with hub, waterstop, anchor ring, and locking devices. Include gland, bolts, and nuts.
   3. Housing-to-Sleeve Gasket: EPDM rubber.
   4. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber.
   5. Pipe Sleeve: AWWA C151, ductile-iron pipe or ASTM A 53/A 53M, Schedule 40, zinc-coated steel pipe.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

B. Examine floors, substrates, and conditions under which fixture work to be accomplished.

C. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.

D. Do not proceed with Work until unsatisfactory conditions corrected.

E. Do not use new fixtures during construction unless approved in writing by the Owner's Representative.

F. Contractor to CALL Underground Service Alert at 811 or submit a location request at call811.com at least two business days before digging fore trench http://www.socalgas.com/safety/dig-alert.shtml.

3.2 INSTALLATION GENERAL REQUIREMENTS

A. Provide, apply, install, connect, erect, clean, and condition manufactured materials and equipment as recommended in manufacturer's printed directions (maintained on job site during installation).

B. Provide all attachment devices and materials necessary to secure materials together or to other materials.

C. Make allowances for ample and normal expansion and contraction for all building components and piping systems that are not subject to such.

D. Install materials only when conditions of temperature, moisture, humidity and conditions of adjacent building components are conductive to achieving the best installation results.

E. Erect, install and secure components in a structurally sound and appropriate manner.

F. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.

G. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.

H. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking or other disfigurement.

I. Conduct work in a manner to avoid injury or damage to previously placed work.

J. Any work so impaired or damaged shall be replaced at no expense to the Owner's Representative.

K. Fabricate and install materials true to line, plumb and level.

L. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents and other imperfections.

M. Furnish materials in longest practical lengths and largest practical sizes to avoid all unnecessary jointing.

N. Make all joints secure, tightly fitted, and as inconspicuous as possible by the best, accepted practice in joinery and fabrication.

O. Consult the Owner's Representative for mounting or position of any unit not specifically indicated or located on drawings or specified in specifications.

P. Job mixed multi component materials used in the work shall be mixed in such regulated and properly sized batches that materials can be used before it begins to set.

Q. Mixing of a partially set batch with another batch of fresh materials will not be accepted and entire batch shall be discarded and removed from the site.

R. Clean all mixing tools and appliances that can be contaminated prior to mixing of fresh materials.

S. In addition to the above, refer to each section of the specifications for additional installation requirements for the proper completion of the work.

3.3 INSTALLATION OF PLUMBING FIXTURES

A. General: Install plumbing fixtures of types indicated where shown and at indicated heights, in accordance with fixture manufacturer's written instructions, roughing-in drawings, and recognized industry practices. Ensure plumbing fixtures comply with requirements and serve intended purposes. Comply with 2013 California Plumbing Code.

B. Installation

1. Set fixtures level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping behind or within wall to prevent movement of exposed piping.
2. Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.
3. Install barrier free fixtures in compliance with ILHR 52 and Federal ADA Accessibility Guidelines. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to 27 inches above floor to avoid contact by wheelchair users.
4. Provide unions at water connections to drinking fountains and electric water coolers.
5. Cover pipe penetrations with escutcheons. Exposed traps, piping and escutcheons to be chrome plated brass. Cover exposed water closet bolts with bolt covers.
6. Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.
7. Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Insulated Piping: One-piece, stamped-steel type.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type.
5. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type.
6. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
7. Bare Piping at Floor Penetrations in Equipment Rooms: Split casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide minimum 1/2-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than NPS 4.
      b. Steel Sheet Sleeves: For pipes NPS 4 and larger, penetrating gypsum-board partitions.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Section 07 92 00 – Joint Sealers.
         1) Seal space outside of sleeve fittings with grout.
   4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Section 07 92 00 – Joint Sealers for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
   3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations
   1. Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section 07 8413 – PENETRATION FIRE STOP SYSTEMS.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.5 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. 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.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   3. PVC Non-pressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion

3.6 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Dry Piping Systems: Install dielectric flanges to connect piping materials of dissimilar metals.
   4. Wet Piping Systems: Install dielectric flanges to connect piping materials of dissimilar metals.

3.7 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping
   1. NPS 1-1/2 and Smaller: Fitting-type coupling.
   2. NPS 2 and Larger: Sleeve-type coupling.

3.8 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.9 WALL PENETRATION SYSTEM INSTALLATION

A. Install wall penetration systems in new, exterior concrete walls.

B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

3.10 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.11 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Sections 09 9100 – IPAINTING.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.12 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000 psi, 28-day compressive-strength concrete and reinforcement.

3.13 FIELD QUALITY CONTROL

A. Upon completion of installation and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance, or remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site, or remove fixture and replace with new unit. Feasibility and match to be judged by the Owner’s Representative. Remove cracked or dented units and replace with new units.

3.14 ADJUSTING

A. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust self-closing lavatory faucets to 15 second cycle. Adjust shower valve temperature limit stops to 110 degree F maximum outlet temperature.

B. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm without splashing, noise or overflow.

C. Adjust or replace washers to eliminate leaks at faucets or stops.

3.15 CLEANING

A. Clean plumbing fixtures, trim, and strainers of dirt debris upon completion of installation.

3.16 EXTRA STOCK

A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner’s Representative with receipt. Furnish 1 device for every 10 units.

3.17 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 05 5000 – METAL FABRICATIONS.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.18 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.19 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 220700
PLUMBING INSULATION

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Section 22 0500 – COMMON WORK RESULTS FOR PLUMBING.

1.2 SUMMARY

A. This Section includes the following:
   1. Insulation Materials
      a. Cellular glass.
      b. Flexible elastomeric.
      c. Mineral fiber.
   2. Insulating Cements
   3. Adhesives.
   4. Mastics.
   5. Lagging adhesives.
   6. Sealants.
   7. Field-applied fabric-reinforcing mesh.
   8. Field-applied jackets.
   9. Tapes.
   10. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 01 8113 of this Specifications Manual.

B. Related Sections include the following:
   1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 01 8113 of this Specifications Manual. Furnish submittals as required in Section 01 8113-1.4 for all relevant materials in this section

C. .Shop Drawings
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application at linkages of control devices.
   7. Detail field application for each equipment type.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
   1. Sample Sizes
      a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
      b. Sheet Form Insulation Materials: 12 inches square.

c. Jacket Materials for Pipe: 12 inches long by NPS 2.
d. Sheet Jacket Materials: 12 inches square.
e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

E. Qualification Data: For qualified Installer.

F. Material Test Reports: From a qualified testing agency acceptable to Owner's Representative indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

G. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: All insulation shall comply with fire and smoke hazard ratings indicated by ASTM E84, NFPA and UL. Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency Owner's Representative. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Section 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: provide one of the following:
      a. Pittsburgh Corning Corporation; Foamglas Super K.
      b. Cell-U-Foam Corporation; Ultra-CUF.
      c. Or equal
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
   1. Products: provide one of the following:
      a. Armacell LLC; AP Armaflex
      b. Aeroflex USA Inc.; Aerocel.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180
      d. Or equal

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: provide one of the following:
      a. CertainTeed Corp.; SoftTouch Duct Wrap.
      a. Johns Manville; Microlite.
      b. Knauf Insulation; Friendly Feel Duct Wrap.
      c. Manson Insulation Inc.; Alley Wrap.
      d. Owens Corning; SOFTR All-Service Duct Wrap.
      e. Or equal

H. Mineral-Fiber, Preformed Pipe Insulation
   1. Products: provide one of the following:
      a. Johns Manville; Micro-Lok
      b. Knauf Insulation; 1000 Pipe Insulation
      c. Owens Corning; Fiberglas Pipe Insulation
      d. Or equal
   2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: provide one of the following:
      a. Johns Manville; MicroFlex
      b. CertainTeed Corp.; CrimpWrap
      c. Knauf Insulation, Pipe and Tank Insulation
      d. Owens Corning; Fiberglas Pipe and Tank Insulation
      e. Or equal

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
   1. Products: provide one of the following:
      a. Insulco, Division of MFS, Inc.; Triple I.
      b. Ramco Insulation, Inc.; Super-Stik.
      c. Or equal

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
   1. Products: provide one of the following:
      a. Ramco Insulation, Inc.; Thermokote V.
      b. Or equal

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
   1. Products: provide one of the following:
      a. Insulco, Division of MFS, Inc.; SmoothKote.
      b. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.
      c. Rock Wool Manufacturing Company; Delta One Shot.
      d. Or equal

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 degrees F.
   1. Products: provide one of the following:
      a. Childers Products, Division of ITW; CP-96
      b. Foster Products Corporation, H. B. Fuller Company; 81-33.
      c. Or equal
   2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products: provide one of the following:
      a. Aeroflex USA Inc.; Aeroseal.
      b. Armacell LCC; 520 Adhesive.
      c. Foster Products Corporation, H. B. Fuller Company; 85-75.
      d. RBX Corporation; Rubatex Contact Adhesive.
      e. Or equal
   2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: provide one of the following:
      a. Childers Products, Division of ITW; CP-82
      b. Foster Products Corporation, H. B. Fuller Company; 85-20.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.
      f. Or equal
   2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Products: provide one of the following:
      a. Dow Chemical Company (The); 739, Dow Silicone.
      b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
      c. P.I.C. Plastics, Inc.; Welding Adhesive.

d. Speedline Corporation; Speedline Vinyl Adhesive.
e. Or equal

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: provide one of the following:
a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.
c. Or equal
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 degrees F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: provide one of the following:
a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.
g. Or equal
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
1. Products: provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
c. Vimasco Corporation; 713 and 714.
d. Or equal
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 degrees F.
4. Color: White.

2.6 SEALANTS

A. Joint Sealants
1. Joint Sealants for Cellular-Glass:provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.

e. Pittsburgh Corning Corporation; Pittseal 444.
f. Or equal
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 degrees F.
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Metal Jacket Flashing Sealants:
1. Products: provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.
e. Or equal
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Or equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 degrees F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
1. Products: provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.
b. Vimasco Corporation; Elastafab 894.
c. Or equal

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.
1. Products: provide one of the following:
a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.
c. Or equal

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: provide one of the following:
   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto PVC Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.
   e. Or equal
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Owner's Representative.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:
1. Products: provide one of the following:
   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.
   d. Or equal
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   d. Factory-Fabricated Fitting Covers:
      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: provide one of the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
   b. Compac Corp.; 130.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
   d. Venture Tape; 1506 CW NS.
   e. Or equal
2. Width: 3 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: provide one of the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.
   e. Or equal
2. Width: 2 inches.
3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
7. Tensile Strength: 34 lbf/inch in width.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 degrees F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use de-mineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 07 84 13 – Penetration Firestop Systems.

F. Insulation Installation at Floor Penetrations
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 – Penetration Firestop Systems.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

B. Insulation Installation on Pipe Flanges
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties
   1. Install preformed sections of cellular-glass insulation to valve body.
   2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

B. Insulation Installation on Pipe Flanges
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Equipment and Pipe Insulation with Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections
   1. Inspect field-insulated equipment, randomly selected by Owner's Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
   2. Inspect pipe, fittings, strainers, and valves, randomly selected by Owner's Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water: All piping exposed in plenums or above ceilings
   1. NPS 1 1/4 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Hot Water Return, Industrial Hot and Hot Water Return, Tempered Water Supply and Return:: All piping
   1. NPS 3/4 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1 and Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 1/2 inch thick.

C. Industrial Cold Water and Irrigation Piping: All piping exposed in plenums or above ceilings
   1. NPS 1 1/4 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. ~~Sanitary~~ Laboratory Vents terminating through the roof: **ADD-3**
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

E. Condensate and Equipment Drain Water below 60 Degrees F
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Degrees F
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic and Industrial Cold Water Piping: All piping above ceilings.
   1. NPS 1 1/4 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Hot Water Return, Tempered Water Supply and Return: All piping
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 2 inches thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. For vertical piping, provide 16 mil thick stucco embossed pattern finish, type 1100 aluminum jacket, ASTM B209. For horizontal pipe, locate lap on bottom. For fittings, provide 24 mil thick die shaped, smooth finish, type 1100jacket, ASTM B209. Provide 0.5” wide, 20 mil thick, Type 3003 alumnium bands on maximum 24” centers but less than two bands per jacket section.

3.16 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. For vertical piping, provide 16 mil thick stucco embossed pattern finish, type 1100 aluminum jacket, ASTM B209. For horizontal pipe, locate lap on bottom. For fittings, provide 24 mil thick die shaped, smooth finish, type 1100jacket, ASTM B209. Provide 0.5” wide, 20 mil thick, Type 3003 alumnium bands on maximum 24” centers but less than two bands per jacket section.

END OF SECTION

SECTION 221116
PLUMBING PIPING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 220500 – Common Work Results for Plumbing.

C. Refer to Section 083100 – Access Door and Panels.

1.2 SUMMARY

A. Section Includes
   1. Under-building slab and aboveground water pipes, tubes, fittings, and specialties inside the building. This specification also applies to industrial water piping, irrigation piping inside the building and solar heating system piping.
   2. Encasement for piping.
   3. Specialty valves.
   4. Flexible connectors.
   5. Escutcheons.
   6. Sleeves.
   7. Sleeve seals.
   8. Wall penetration systems.
   9. Grout.

B. Related Section
   1. General: Refer to Section 220500 - COMMON WORK RESULTS FOR PLUMBING.

C. Performance Requirements
   1. Seismic Performance: Water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

A. Product Data: For the following products:
   1. Specialty valves.
   2. Flexible connectors.
   3. Backflow preventers and vacuum breakers.

B. LEED Submittal
   1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Water Samples: Specified in "Cleaning" Article.

D. Coordination Drawings: For piping in equipment rooms and other congested areas, provide drawings drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
   1. Fire-suppression-water piping.
   2. Plumbing piping.
   3. Electrical conduit and devices.
   4. HVAC hydronic piping and ductwork.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than five days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's written permission.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 LEAD FREE INSTALLATION

A. The contractor shall install only products that comply with the requirements as described in State Assembly Bill AB-1953 for lead free products. Submit all lead free products to be installed to the engineer for review.

PART 2 PRODUCTS

2.1 MATERIALS

A. Potable Water, Tempered Water and Non-Potable (Industrial) Water Piping

1. Above Grade
   a. All piping shall be hard drawn copper tubing, ASTM B88, Type ~~K~~L. Fittings for . **ADD-3** copper tubing shall be wrought copper.
2. Below Grade
   a. All piping shall be hard drawn copper tubing, ASTM B88, Type K. Fittings for copper tubing shall be wrought copper. Copper pipe to be pipe wrapped.

B. Natural Gas

1. Above Grade
   a. Low pressure and all medium pressure 2” and smaller shall be black steel pipe, Schedule 40, Type E or S, Grade B, ASTM A53; with black malleable iron threaded fittings, Class 150, ASTM A197/ANSI B16.3.
   b. Low pressure and all medium pressure 2-1/2 inches and larger shall be black steel pipe, Schedule 40, Type E or S, Grade B, ASTM A53; with seamless carbon steel weld fittings, ASTM A234 grade WPB/ANSI B16.9.
2. Natural Gas Vent, Above Grade
   a. 2” and smaller shall be galvanized steel pipe, Schedule 40, Type E or S, Grade B, ASTM A53; with black malleable iron threaded fittings, Class 150, ASTM A197/ANSI B16.3.
   b. 2-1/2 inches and larger shall be Galvanized steel pipe, Schedule 40, Type E or S, Grade B, ASTM A53; with seamless carbon steel weld fittings, ASTM A234 grade WPB/ANSI B16.9.

C. Dissimilar Piping Joints

1. Use non-conductive fittings whenever ferrous and non-ferrous piping materials are joined together.
2. Dielectric unions and couplings shall not be used.

D. Domestic or Industrial Water: Threaded M.P.S. minimum 3-inches long electro-zinc plated steel casing with inert NSF/FDA listed lining. ASTM F-492 rated at 225°F, 300 PSI. ClearFlow by Precision Plumbing Products Inc, or equal.

2.2 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Sheet or Tube.

C. Material: LLDPE film of 0.008-inch minimum thickness.

D. Color: Black.

2.3 SPECIALTY VALVES

A. Comply with requirements in Section 22 05 23 – General Duty Valves for Plumbing Piping for general-duty metal valves.

B. Comply with requirements in Section 22 11 19 – Plumbing Water Piping Specialties for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.4 TRANSITION FITTINGS

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

2.5 DIELECTRIC FITTINGS

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

2.6 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by Metraflex Inc. or one of the following:
   1. Flex-Hose Co., Inc.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
   1. Working-Pressure Rating: Minimum 200 psig.
   2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
   3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
   1. Working-Pressure Rating: Minimum 200 psig.
   2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.7 ESCUTCHEONS

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

2.8 SLEEVES

A. General: Refer to Section 220500 – Common Work Results for Plumbing.

2.9 SLEEVE SEALS

A. General: Refer to Section 220500 – Common Work Results for Plumbing.

2.10 WALL PENETRATION SYSTEMS

A. General: Refer to Section 220500 – Common Work Results for Plumbing.

2.11 GROUT

A. General: Refer to Section 220500 – Common Work Results for Plumbing.

PART 3 EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 – Earth Moving for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper in PE encasement according to ASTM A 674 or AWWA C105.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each water service entrance. Comply with requirements in Section 220519 – Meters and Gages for Plumbing Piping for pressure gages and Section 221119 – Plumbing Water Piping Specialties for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water piping level and plumb.

G. Install seismic restraints on piping. Comply with requirements in Section 220548 – Vibration and Seismic Controls for Plumbing Piping and Equipment for seismic-restraint devices.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping adjacent to equipment and specialties to allow service and maintenance.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections. Notched tees (T-drill) are not acceptable. Use standard or reducing tees for branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gauges on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Section 220519 – Meters and Gages for Plumbing Piping for pressure gages.

R. Install thermostats in hot-water circulation piping. Comply with requirements in Section 221123 – Domestic Water Pumps for thermostats.

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Section 220519 – Meters and Gages for Plumbing Piping for thermometers.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

G. Pressure-sealed jointing system for copper piping are not acceptable and shall not be used.

H. Extruded tee connections are not acceptable and shall not be used.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Section 220523 – General Duty Valves for Plumbing Piping for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

3.5 TRANSITION FITTING INSTALLATION

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

3.6 DIELECTRIC FITTING INSTALLATION

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each water pump and in suction and discharge manifold connections to each water booster pump.

B. Install bronze-hose flexible connectors in copper water tubing.

C. Install stainless-steel-hose flexible connectors in steel water piping.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment for seismic restraint devices.

B. Comply with requirements Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8-inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 ESCUTCHEON INSTALLATION

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

3.11 SLEEVE INSTALLATION

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

3.12 SLEEVE SEAL INSTALLATION

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

3.13 WALL PENETRATION SYSTEM INSTALLATION

A. General: Refer to Section 22 05 00 – Common Work Results for Plumbing.

3.14 IDENTIFICATION

A. Identify system components. Comply with requirements in Section 22 05 53 – Identification for Plumbing Piping and Equipment for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.15 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests
   1. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.

D. Water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.16 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
      a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
      b. Adjust calibrated balancing valves to flows indicated.
   5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.17 CLEANING

A. Clean and disinfect potable and non-potable water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water / chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water / chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of water piping system. Remove dirt and debris as work progresses.

3.18 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, building water service piping and irrigation piping, NPS 3 and larger, shall be the following:

1. Hard copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints. Provide PE encasement.

D. Under-building-slab, plumbing and irrigation water piping, NPS 2-1/2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints. Provide PE encasement.

E. Aboveground domestic, industrial~~, irrigation and solar heating~~ system water piping shall be . **ADD-3** the following:

1. Hard copper tube, ASTM B 88, Type ~~K~~L, cast- or wrought- copper solder-joint fittings; . **ADD-3** and soldered joints.

3.19 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shut-off Duty: Use ball valves for piping NPS 2 and smaller. Use gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use globe valves for piping NPS 2 and smaller. Use globe valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 221119
PLUMBING PIPING SPECIALTIES

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Section 220500 – COMMON WORK RESULTS FOR PLUMBING.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Water pressure-reducing valves.
   4. Temperature-actuated water mixing valves.
   5. Strainers.
   6. Hose bibbs.
   7. Wall hydrants.
   8. Water hammer arresters.
   9. Air vents.
   10. Trap-seal primer valves.
   11. Trap seal primer systems.

B. Related Sections include the following:
   1. Section 220519 – METERS AND GAGES FOR PLUMBING PIPING for thermometers, pressure gages, and flow meters in domestic water piping.
   2. Section 221116 – PLUMBING PIPING.
   3. Section 224500 – EMERGENCY PLUMBING FIXTURES for water tempering equipment.
   4. Section 224700 – DRINKING FOUNTAINS AND WATER COOLERS for water filters for water coolers.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 01 8113 of this Specifications Manual.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

E. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 01 8113 of this Specifications Manual. Furnish submittals as required in Section 01 8113-1.4 for all relevant materials in this section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Inspector of Record, and marked for intended use.

B. NSF Compliance
   1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

1.6 LEAD FREE INSTALLATION

A. The Contractor shall install only products that comply with the requirements as described in State Assembly Bill AB-1953 for lead free products. Submit all lead free products to be installed to the Owner's Representative for review.

PART 2 PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers
   1. Manufacturers:
      a. Ames Co.
      b. ConBraCo Industries, Inc.
      c. FEBCO; SPX Valves & Controls
      d. Watts Industries, Inc.; Water Products Div.
      e. Or equal
   2. Standard: ASSE 1001.
   3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
   4. Body: Bronze.
   5. Inlet and Outlet Connections: Threaded.
   6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers
   1. Manufacturers:
      a. Arrowhead Brass Products, Inc.
      b. ConBraCo Industries, Inc.
      c. Woodford Manufacturing Company
      d. Watts Industries, Inc.; Water Products Div.
      e. Or equal
   2. Standard: ASSE 1011.
   3. Body: Bronze, nonremovable, with manual drain.
   4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
   5. Finish: Match hose bib material.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers, RPBP-1, 2, 3 & 4
   1. Product:
      a. Wilkins . **ADD-3**
      ~~a.~~b. Ames Co.
      ~~b. ConBraCo Industries, Inc.~~ . **ADD-3**
      c. FEBCO; SPX Valves & Controls
      d. Watts Industries, Inc.; Water Products Div.
      e. Or equal
   2. Standard: ASSE 1013.
   3. Operation: Continuous-pressure applications.
   4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
   5. Size: Refer to equipment schedule

6. Design Flow Rate: Refer to equipment schedule
7. Body: Lead free material. Bronze for NPS 2 and smaller; ductile iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
9. Configuration: Designed for horizontal, straight through flow.
10. Accessories
11. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
12. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Backflow-Preventer Test Kits
   1. Manufacturers:
      a. FEBCO; SPX Valves & Controls
      b. ConBraCo Industries, Inc.
      c. Flomatic Corporation
      d. Watts Industries, Inc.; Water Products Div.
      e. Or equal
   2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators
   1. Manufacturers:
      a. ConBraCo Industries, Inc.
      b. Watts Industries, Inc.; Water Products Div.
      c. Zurn Plumbing Products Group; Wilkins Div.
      d. Or equal
   2. Standard: ASSE 1003.
   3. Pressure Rating: Initial working pressure of 150 psig.
   4. Size: Refer to equipment schedule.
   5. Design Flow Rate: Refer to equipment schedule.
   6. Design Inlet Pressure: Refer to equipment schedule.
   7. Design Outlet Pressure Setting: Refer to equipment schedule.
   8. Body: Lead free material. Cast Bronze
   9. Valves for Booster Heater Water Supply: Include integral bypass.
   10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices, TMV-1
   1. Product:
      a. Bradley Corp.
      b. Leonard Valve Company
      c. Symmons Industries, Inc.
      d. Watts Industries, Inc.; Water Products Div.
      e. Zurn Plumbing Products Group; Wilkins Div.
      f. Or equal
   2. Standard: ASSE 1017.
   3. Pressure Rating: 125 psig.
   4. Type: Thermostatically controlled water mixing valve.
   5. Material: Bronze body with corrosion-resistant interior components.
   6. Connections: Threaded with unions on inlets and outlet.
   7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
   8. Tempered-Water Setting: Refer to equipment schedule.
   9. Tempered-Water Design Flow Rate: Refer to equipment schedule.
   10. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves, TMV-2 & 3

1. Product:
   a. Bradley Corp.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company
   d. Powers; a Watts Industries Co.
   e. Or equal
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Wall bracket, manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle, and inlet and outlet shut-off valves.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Tempered-Water Setting: Refer to equipment schedule.
10. Tempered-Water Design Flow Rate: Refer to equipment schedule.
11. Valve Finish: Rough bronze.
12. Piping Finish: Copper.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers Refer to equipment schedule for equipment type.
   1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
   2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
   3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   4. Screen: Stainless steel with round perforations, unless otherwise indicated.
   5. Perforation Size
      a. Strainers NPS 2 and Smaller: 0.020-inch.
      b. Strainers NPS 2-1/2 to NPS 4: 0.045-inch.
      c. Strainers NPS 5 and larger: 0.10-inch.
   6. Drain: Pipe plug.

2.6 WALL HYDRANTS

A. Wall Hydrants, HB-1
   1. Manufacturers:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Woodford Manufacturing Company.
      d. Or equal
   2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
   3. Pressure Rating: 125 psig.
   4. Operation: Loose key.
   5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   6. Inlet: NPS 3/4.
   7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   8. Box: Deep, flush mounting with cover.
   9. Box and Cover Finish: Lockable Cover with Polished nickel bronze.
   10. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
   12. Operating Keys(s): One with each wall hydrant.

B. Moderate-Climate Wall Hydrants, HB-2
   1. Manufacturers:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Woodford Manufacturing Company.
      d. Or equal

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4.
6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Lockable Cover with Polished nickel bronze.
9. Operating Keys(s): One with each wall hydrant.

2.7 WATER HAMMER ARRESTERS

A. Water Hammer Arresters.
   1. Manufacturers:
      a. Sioux Chief Manufacturing Company, Inc.
      b. Or equal
   2. Standard: ASSE 1010 or PDI-WH 201.
   3. Type: Copper tube with piston.
   4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.8 AIR VENTS

A. Bolted-Construction Automatic Air Vents.
   1. Body: Bronze.
   2. Pressure Rating: 125 psig minimum pressure rating at 140 degrees F.
   3. Float: Replaceable, corrosion-resistant metal.
   4. Mechanism and Seat: Stainless steel.
   5. Size: NPS 1/2 minimum inlet.
   6. Inlet and Vent Outlet End Connections: Threaded.

2.9 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves, TP-1
   1. Manufacturers:
      a. Sioux Chief Manufacturing Company, Inc.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Watts Industries, Inc.; Water Products Div.
      d. Or equal
   2. Standard: ASSE 1018.
   3. Pressure Rating: 125 psig minimum.
   4. Body: Bronze.
   5. Inlet and Outlet Connections: threaded, union, or solder joint.
   6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
   7. Finish: Rough bronze.

2.10 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems, TP-2
   1. Manufacturers:
      a. Sioux Chief Manufacturing Company, Inc.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Watts Industries, Inc.; Water Products Div.
      d. Or equal
   2. Standard: ASSE 1044,
   3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
   4. Cabinet: Recessed-mounting steel box with stainless-steel cover. Provide fire-rated box when installed in fire rated walls.
   5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
   6. Vacuum Breaker: ASSE 1001.
   7. Number Outlets: Refer to drawings, maximum 4 drains served using distribution units.

8. Size Outlets: NPS 1/2.
9. Electrical Requirements: 0.33 amps, 120 volts-60 Hertz

B. Trap-Seal Primer Systems, TP-3
   1. Manufacturers:
      a. Sioux Chief Manufacturing Company, Inc.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Watts Industries, Inc.; Water Products Div.
      d. Or equal
   2. Standard: ASSE 1044,
   3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
   4. Cabinet: Recessed-mounting steel box with stainless-steel cover. Provide fire-rated box when installed in fire rated walls.
   5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
   6. Vacuum Breaker: ASSE 1001.
   7. Number Outlets: Refer to drawings, maximum 10 drains served.
   8. Size Outlets: NPS 1/2.
   9. Electrical Requirements: 0.33 amps, 120 volts-60 Hertz

PART 3 EXECUTION

3.1 INSTALLATION

A. Refer to Section 220500 – COMMON WORK RESULTS FOR PLUMBING for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with 2013 California Plumbing Code.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
   3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.

D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

F. Install water hammer arresters in water piping according to PDI-WH 201. Provide at every branch to multiple fixtures for both cold and hot water piping. Install in ceiling as indicated in drawings or where it would be difficult to fit the device in the wall.

G. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow. Install trap-seal primer valves behind access panels. Access panels shall have an opening sized 18”x18” minimum for non-full body access.

I. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

C. Connect wiring according to Section 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Water pressure-reducing valves.
3. Primary, thermostatic, water mixing valves.
4. Supply-type, trap-seal primer valves.
5. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each vacuum breaker and reduced-pressure-principle backflow assembly according to DWP and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure setpoints of water pressure-reducing valves.

B. Set field-adjustable temperature setpoints of temperature-actuated water mixing valves.

END OF SECTION

SECTION 221223
FACILITY INDOOR POTABLE WATER STORAGE TANKS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 220500 – Common Work Results for Plumbing.

1.2 SUMMARY

A. This Section includes potable-water storage tanks and related accessories for indoor installation.

1.3 DEFINITIONS

A. HDPE: High-density polyethylene plastic.

B. LDPE: Low-density polyethylene plastic.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories. Indicate dimensions, wall thickness, insulation, finishes and coatings, required clearances, methods of assembly of components, and piping connections.

B. Manufacturer Seismic Qualification Certification: Submit certification that indicated steel, potable-water storage tanks, accessories, and components will withstand seismic forces defined in Section 220548 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by manufacturers certifying that potable-water storage tanks comply with requirements.

D. Source quality-control test reports.

E. Purging and disinfecting reports.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of potable-water storage tanks and are based on the specific system indicated. Refer to Section 016000 – Product Requirements.

B. ASME Compliance for Steel Tanks: Fabricate and label steel, potable-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 LEAD FREE INSTALLATION

A. The contractor shall install only products that comply with the requirements as described in State Assembly Bill AB-1953 for lead free products. Submit all lead free products to be installed to the engineer for review.

PART 2 PRODUCTS

2.1 ~~PLASTIC, NONPRESSURE,~~ . POTABLE-WATER STORAGE TANKS

A. ~~PE~~ Steel . Potable-Water Storage Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by ~~Snyder Industries~~Bradford White , Inc. or one of the following:
   a. ~~Amprotec, Inc.; Tank System Division~~Lochinvar.
   ~~a.~~b. AO Smith.
   ~~b. Assmann Corporation of America.~~
   ~~c. Chem-Tainer Industries.~~
   ~~d. Poly Processing Company.~~
   ~~e. Premier Plastics Inc.~~
   ~~f. Steel Tank and Fabricating.~~
   ~~g. TolPlast Company, Inc.~~ .
   ~~h.~~c. Or approved equal
2. Description: Heavy gauge steel with internal anti corrosion “Vitraglas” lining and external insulation.
   a. Water Connections—3" NPT fittings
   b. Magnesium Anode Rods
   c. One 3/4" NPT Aquastat Fitting
   d. Cleanout and Manway opening for inspection and maintenance.
   e. Tanks to be constructed and certified in accordance with ASME Sect. IV, Part HLW for 150 PSI.

~~1. PE, vertical, flat-bottom, nonpressure-rated water tank; complying with NSF 61 barrier materials for potable-water tanks.~~
~~2. Construction: ASTM D 1998, molded PE.~~
~~3. Tappings: Factory-fabricated bulkhead fittings attached to tank.~~
~~a. NPS 2 and Smaller: With female thread.~~
~~b. NPS 2-1/2 and Larger: Flanged.~~
~~4. Vertical Tank Support: Separate factory-fabricated steel stand capable of supporting entire bottom of tank.~~

~~B. Manhole: Watertight, for tank more than 36 inches in diameter.~~

~~C. Cover for Open Tank: Plastic, same as or similar to tank material and with shape that encloses top of tank.~~

~~D. Specialties and Accessories: Include tappings in the tank and the following:~~
~~1. Vacuum relief valve.~~
~~2. Free air vent with insect screen.~~ . **ADD-3**

2.2 STEEL, PRECHARGED, POTABLE-WATER STORAGE TANKS~~, DT-1 & ET-1~~ . **ADD-3:**

A. Steel, Precharged, Bladder, Water Storage Tanks

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or equal product by one of the following:
   a. Amtrol . **ADD-3**
   ~~a.~~b. Armstrong Pumps, Inc.
   ~~b.~~c. Bell & Gossett
   ~~c. Flo Fab inc.~~ . **ADD-3**

~~d. Taco, Inc.~~ . **ADD-3**
~~e.~~d. Wessels Company
~~f.~~e. Or Approved equal.

2. Description: Steel, vertical, pressured-rated tank with cylindrical sidewalls and with air-charging valve and air precharge.
3. Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.
4. Operation: Factory-installed, butyl-rubber bladder.
5. Construction: ASME code, steel, constructed with nontoxic welded joints, for 150-psig working pressure.
6. Tappings: Factory-fabricated steel, welded to tank before testing and labeling.
   a. NPS 2 and Smaller: ASME B1.20.1, with female thread.
   b. NPS 2-1/2 and Larger: ASME B16.5, flanged.
7. Specialties and Accessories: Include tappings in tank and the following:
   a. Pressure gauge.
8. Vertical Tank Supports: Factory-fabricated steel legs or steel skirt, welded to tank before testing and labeling.
9. Tank Interior Finish: Materials and thicknesses complying with NSF 61 barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
   a. Lining Material: Cement.
   b. Coating: Epoxy resin.
10. Exterior Coating: Manufacturer's standard enamel paint.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect potable-water storage tanks according to the following tests and inspections and prepare test reports:
   1. Pressure Testing for ASME-Code, Potable-Water Storage Tanks: Hydrostatically test to ensure structural integrity and freedom from leaks. Fill tanks with water, vent air, pressurize to 1-1/2 times tank pressure rating, disconnect test equipment, hold pressure for 30 minutes with no drop in pressure, and check for leaks. Replace tanks that fail test with new tanks, and repeat until test is satisfactory.
   2. Testing for Nonpressure, Potable-Water Storage Tanks: Fill tanks to water operating level to ensure structural integrity and freedom from leaks. Hold water level for two hours with no drop in water level

B. Repair or replace tanks that fail test with new tanks, and repeat until test is satisfactory.

PART 3 EXECUTION

3.1 CONCRETE BASES

A. Install concrete bases of dimensions indicated for tanks. Refer to Section 22 05 00 – Common Work Results for Plumbing.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
   2. For supported tanks, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported tanks.

B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

A. Install water storage tanks on concrete bases, level and plumb, firmly anchored. Arrange so devices needing servicing are accessible.

B. Anchor tank supports and tanks to substrate.
   1. Use steel or FRP straps over or around plastic tanks.

C. Install tank seismic restraints.

D. Install thermometers and pressure gauges on water storage tanks and piping, if indicated. Thermometers and pressure gages are specified in Section 22 05 19 – Meters and Gages for Plumbing Piping.

E. Install combination temperature and pressure relief valves in top portion of pressure storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor sink.

F. Install the following devices on tanks where indicated:
   1. Connections to accessories.

G. After installing tanks with factory finish, inspect finishes and repair damages to finishes.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to potable-water storage tanks to allow service and maintenance.

C. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.
   1. General-duty valves are specified in Section 22 05 23 – General Duty Valves for Plumbing Piping.
      a. Valves NPS 2 and Smaller: Ball.
      b. Valves NPS 2-1/2 and Larger: Gate.
      c. Drain Valves: NPS 3/4 ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.
   2. Water Piping Connections: Make connections to dissimilar metals with dielectric fittings. Dielectric fittings are specified in Section 22 05 00 – Common Work Results for Plumbing.

3.4 FIELD QUALITY CONTROL

A. Perform the following final checks before filling:
   1. Verify that air precharge in precharged tanks is correct.
   2. Test operation of tank accessories and devices.
   3. Verify that pressure relief valves have correct setting.
      a. Manually operate pressure relief valves.
      b. Adjust pressure settings.

B. Filling Procedures: Follow manufacturer's written procedures. Fill tanks with water to operating level.

3.5 CLEANING

A. Clean and disinfect potable-water storage tanks.

B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in AWWA C652 or as described below:
   1. Purge water storage tanks with potable water.
   2. Disinfect tanks by one of the following methods:
      a. Fill tanks with water-chlorine solution containing at least 50 ppm of chlorine. Isolate tanks and allow to stand for 24 hours.
      b. Fill tanks with water-chlorine solution containing at least 200 ppm of chlorine. Isolate tanks and allow to stand for three hours.
   3. Flush tanks, after required standing time, with clean, potable water until chlorine is not present in water coming from tank.
   4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination made by authorities having jurisdiction shows evidence of contamination.

C. Prepare written reports for purging and disinfecting activities.

END OF SECTION

SECTION 221413
FACILITY STORM DRAINAGE PIPING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 220500 – Common Work Results for Plumbing.

1.2 SUMMARY

A. This Section includes the following storm drainage piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.
   3. Encasement for underground metal piping.

1.3 DEFINITIONS

A. LLDPE: Linear, low-density polyethylene plastic.

B. PE: Polyethylene plastic.

C. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
   1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. LEED Submittal
   1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Shop Drawings
   1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
   2. Controlled-Flow Storm Drainage System: Include calculations, plans, and details.

D. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Extra Heavy class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. NSF Certified CISPI Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
   a. Manufacturers
      1) ANACO.
      2) Mission Rubber Co.
      3) Tyler Pipe; Soil Pipe Div.
      4) Or Approved Equal
2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
   a. Manufacturers
      1) ANACO.
      2) Mission Rubber Co.
      3) Tyler Pipe; Soil Pipe Div.
      4) Or Approved Equal

~~2.4 RECTANGULAR DRAIN PIPE AND FITTINGS~~

~~A. Pipe and Fittings: City of LA Approved, Research Report RR-5094.~~

~~B. Reinforced fiberglass pipe and fittings with manufacturer approved bonded joint and transition fittings.~~

~~1. Manufacturers~~

~~a. Superior Pipe Co. or approved equal.~~ **ADD-3**

~~2.5~~2.4 PVC PIPE AND FITTINGS

A. Solid-Wall Perforated PVC Pipe: ASTM D 2729, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2729, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Solvent Cement: ASTM D 2564.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

~~2.6~~2.5 SPECIAL PIPE FITTINGS

A. Shielded, Non-pressure, Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers
   a. Cascade Waterworks Mfg. Co.
   b. Mission Rubber Co.
   c. Or approved equal.

B. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
   1. Manufacturers
      a. Cascade Waterworks Mfg. Co.
      b. Dresser, Inc.; DMD Div.
      c. EBAA Iron Sales, Inc.
      d. JCM Industries, Inc.
      e. Romac Industries, Inc.
      f. Smith-Blair, Inc.
      g. Viking Johnson
      h. Or approved equal
   2. Center-Sleeve Material: Manufacturer's standard.
   3. Gasket Material: Natural or synthetic rubber.
   4. Metal Component Finish: Corrosion-resistant coating or material.

~~2.7~~2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105

B. Material: Linear low-density polyethylene film of 0.008-inch minimum thickness.

C. Form: Sheet or tube

D. Color: Black

PART 3 EXECUTION

3.1 EXCAVATION

A. Refer to Section 312000 – Earth Moving for excavating, trenching, and backfilling.

B. PIPING INSTALLATION

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

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. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Storm sewer and drainage piping outside the building are specified in Section 334100 – Storm Utility Drainage Piping.

L. Basic piping installation requirements are specified in Section 220500 – Common Work Results for Plumbing.

M. Install seismic restraints on piping. Seismic-restraint devices are specified in Section 220548 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

N. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

O. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

P. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
   1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

Q. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

R. Install underground PVC piping according to ASTM D 2321.

S. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Section 221423 – Storm Drainage Piping Specialties.

T. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Section 220500 – Common Work Results for Plumbing.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 – Common Work Results for Plumbing

V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Plastic, Non-pressure Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in OD's.
   2. In Drainage Piping: Shielded, non-pressure transition couplings.
   3. In Aboveground Force Main Piping: Fitting-type transition couplings.
   4. In Underground Force Main Piping:
      a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
      b. NPS 2 and Larger: Pressure transition couplings.

3.4 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 – General Duty Valves for Plumbing Piping.

B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
   1. Install gate or full-port ball valve for piping NPS 2 and smaller.
   2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.
   1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
   2. Install backwater valves in accessible locations.
   3. Backwater valve are specified in Section 22 14 23 – Storm Drainage Piping Specialties.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Section 220548 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Pipe hangers and supports are specified in Section 220529 – Hangers and Supports for Plumbing Piping and Equipment. Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Section 220529 – Hangers and Supports for Plumbing Piping and Equipment.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
   2. NPS 3: 60 inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
   4. NPS 6: 60 inches with 3/4-inch rod.
   5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
   6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   5. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, storm water piping shall be the following:
   1. Hubless cast-iron soil pipe and fittings; NSP certified CISPI stainless-steel couplings; and hubless-coupling joints.
   2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Underground, storm water piping shall be any the following:
   1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

END OF SECTION

SECTION 221423
STORM DRAINAGE PIPING SPECIALTIES

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 220500 – Common Work Results for Plumbing.

1.2 SUMMARY

A. This Section includes the following storm drainage piping specialties:

1. Roof Drains
2. Overflow Roof Drains
3. Backwater Valves
4. Trench Drains
~~5. Planter Drains~~ . **ADD-3**
~~6.~~5. Area Drains
~~7.~~6. Gutter Drains
~~8.~~7. Clean Outs
~~9.~~8. Through-penetration fire stop assemblies.
~~10.~~9. Miscellaneous storm drainage piping specialties.
~~11.~~10. Flashing materials.
~~12.~~11. Overflow Drain Outlet Cover

B. Related Sections include the following:

1. Section 221319 – Sanitary Waste Piping Specialties for backwater valves, floor drains, trench drains and channel drainage systems connected to sanitary sewer, air admittance valves, FOG disposal systems, grease interceptors and removal devices, oil interceptors, and solid interceptors.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PUR: Polyurethane plastic.

H. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data

1. Roof Drains.
2. Overflow Roof Drains.
3. Backwater Valves.
4. Trench Drains.
~~5. Planter Drains.~~ . **ADD-3**
~~6.~~5. Area Drains.

~~7.~~6. Gutter Drains.
~~8.~~7. Clean Outs
~~9.~~8. Through-penetration fire stop assemblies.
~~10.~~9. Miscellaneous storm drainage piping specialties.
~~11.~~10. Flashing materials.
~~12.~~11. Overflow Drain Outlet Cover.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 PRODUCTS

2.1 ROOF AND OVERFLOW DRAINS

A. Manufacturers: Subject to compliance with requirements, provide products by Zurn Industries. or equal product by one of the following:
   1. Zurn . **ADD-3**
   ~~1.~~2. Josam Company.
   ~~2.~~3. Smith, Jay R. Mfg. Co.
   ~~3.~~4. Tyler Pipe; Wade Div.
   ~~4.~~5. Or approved equal

B. Roof Drain: RD-1
   1. Description: Dura coated Cast Iron body, 15-inch diameter body, combination membrane flashing clamp, gravel guard, no hub outlet, underdeck clamp, sump receiver and adjustable extension sleeve.
   2. Dome Type: Low silhouette cast iron dome.
   3. 4-inch outlet minimum. Verify pipe size connection indicated on floor plans.

C. Roof Drain: RD-2
   1. Description: Dura coated Cast Iron body, 15-inch diameter body, combination membrane flashing clamp, gravel guard, no hub outlet, underdeck clamp, sump receiver and adjustable extension sleeve.
   2. Dome Type: Low silhouette cast iron dome.
   3. 3-inch outlet.

D. Overflow Roof Drain: ORD-1
   1. Description: Dura coated Cast Iron body, 15-inch diameter body, combination membrane flashing clamp, gravel guard, no hub outlet, underdeck clamp, sump receiver, 2” high external water dam and adjustable extension sleeve.
   2. Dome Type: Low silhouette cast iron dome.
   3. 4-inch outlet minimum. Verify pipe size connection indicated on floor plans.

~~E. Overflow Roof Drain: ORD-2~~
   ~~1. Description: Dura coated Cast Iron body, 15-inch diameter body, combination membrane flashing clamp, gravel guard, no hub outlet, underdeck clamp, sump receiver, 2” high external water dam and adjustable extension sleeve.~~
   ~~2. Dome Type: Low silhouette cast iron dome.~~
   ~~3. 3-inch outlet.~~ . **ADD-3**

2.2 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves, BSV-1:
   1. Manufacturers: Subject to compliance with requirements, provide Zurn Z-1090-BV or equal product by one of the following:
      a. Josam Company

b. MIFAB, Inc.
c. Smith, Jay R. Mfr. Co.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.3 TRENCH DRAINS

A. Manufacturers: Subject to compliance with requirements, provide Zurn Z-665 or equal product by one of the following:

1. Josam Company
2. MIFAB, Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.
6. ACO Polymer Products, Inc.
7. Or approved equal

B. Trench Drain: TD-1

1. Description: Dura coated Cast Iron body, modular extensions as required by trench length, gasket outlet connection and dome bottom strainer.
2. Grate type: 12-inch wide, heel proof secured polished bronze grate.
3. 4-inch outlet minimum. Verify pipe size connection indicated on floor plans.

~~2.4 PLANTER DRAINS~~

~~A. Manufacturers: Subject to compliance with requirements, provide Smith, Jay R. Mfg. Co. 1935Y. or equal product by one of the following:~~

~~1. Josam Company.~~
~~2. Zurn Industries.~~
~~3. Tyler Pipe; Wade Div. Or approved equal~~
~~4. Or approved equal~~

~~B. Planter Drain: PD-1~~

~~1. Description: Dura coated Cast Iron body, 12-inch diameter body, underdeck clamp, flashing clamp and stainless steel perforated gravel stop with 3/8" diameter openings, secured solid cover and polyethylene dome.~~
~~2. 4-inch outlet minimum. Verify pipe size connection indicated on floor plans.~~

~~C. Planter Drain: OPD-1~~

~~1. Description: Dura coated Cast Iron body, 12-inch diameter body, underdeck clamp, flashing clamp and stainless steel perforated gravel stop with 3/8" diameter openings, secured solid cover, 2-inch high PVC standpipe and polyethylene dome.~~
~~2. 4-inch outlet minimum. Verify pipe size connection indicated on floor plans.~~

~~D. Planter Drain: PD-2~~

~~1. Description: Dura coated Cast Iron body, 12-inch diameter body, underdeck clamp, flashing clamp and stainless steel perforated gravel stop with 3/8" diameter openings, secured solid cover and polyethylene dome.~~
~~2. 3-inch outlet minimum. Verify pipe size connection indicated on floor plans.~~

~~E. Planter Drain: OPD-2~~

~~1. Description: Dura coated Cast Iron body, 12-inch diameter body, underdeck clamp, flashing clamp and stainless steel perforated gravel stop with 3/8" diameter openings, secured solid cover, 2-inch high PVC standpipe and polyethylene dome.~~
~~2. 3-inch outlet minimum. Verify pipe size connection indicated on floor plans.~~ . **ADD-3**

~~2.5~~2.4 AREA DRAINS

A. Manufacturers: Subject to compliance with requirements, provide products by Mifab Inc. or equal product by one of the following:
   1. Josam Company.
   2. Zurn Industries.
   3. Smith, Jay R. Mfg. Co.
   4. Tyler Pipe; Wade Div.
   5. Watts Drainage Products Inc.
   6. Or approved equal

B. Promenade Deck Drain: AD-1
   1. Description: Dura coated Cast Iron body with square promenade frame, combination membrane clamp, sediment bucket gasket outlet connection.
   2. Grate Type: 15-inch square nickel bronze, medium duty, heel proof grate.
   3. 4-inch outlet minimum. Verify pipe size connection indicated on floor plans.

C. Promenade Deck Drain: AD-2
   1. Description: Dura coated Cast Iron body with square promenade frame, combination membrane clamp, sediment bucket gasket outlet connection.
   2. Grate Type: 8-inch square nickel bronze, medium duty, heel proof grate.
   3. 3-inch outlet.

~~2.6~~2.5 GUTTER DRAINS

A. Manufacturers: Subject to compliance with requirements, provide Zurn Z-181-BS-HD or equal product by one of the following:
   1. Josam Company
   2. MIFAB, Inc.
   3. Smith, Jay R. Mfg. Co.
   4. Tyler Pipe; Wade Div.
   5. Watts Drainage Products Inc.
   6. Or approved equal

B. Gutter Drain: GD-1
   1. Description: Dura coated Cast Iron body, 6-inch diameter body, membrane clamp, no hub outlet.
   2. Dome Type: 5-3/4 inch high plain bronze slotted dome strainer with mesh screen.
   3. 3-inch outlet minimum. Verify pipe size connection indicated on floor plans.

~~2.7~~2.6 DOWNSPOUT NOZZLE

A. Manufacturers: Subject to compliance with requirements, provide ~~Zurn Z-199-SS~~JR Smith 1620T . or equal product by one of the following: **ADD-3**
   1. Josam Company
   2. MIFAB, Inc.
   3. Smith, Jay R. Mfg. Co.
   4. Tyler Pipe; Wade Div.
   5. Watts Drainage Products Inc.
   6. Or approved equal

B. Down Spout Nozzle: DS-1. Overflow nozzle ODS-1 as applicable.
   1. Description: Nickel Bronze body, threaded inlet.
   2. Wall Flange: Decorative face of wall flange and outlet nozzle.
   3. 3-inch outlet minimum. Verify pipe size connection indicated on floor plans.

~~2.8~~2.7 CLEANOUTS

A. Exposed Metal Cleanouts, WCO:
   1. Manufacturers: Subject to compliance with requirements, provide Zurn Z1446-BP-VP or equal product by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
   2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
   3. Size: Same as connected drainage piping
   4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure: Countersunk, bronze plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
   7. Vandal Proof Screws

B. Metal Floor Cleanouts, FCO:
   1. Manufacturers: Subject to compliance with requirements, provide Zurn ZN1400-BP-HD-KC-VP or equal product by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
   2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
   3. Size: Same as connected branch.
   4. Type: Heavy-duty, adjustable housing.
   5. Body or Ferrule: Cast iron.
   6. Clamping Device: Required.
   7. Outlet Connection: Spigot for slab on grade installation or hubless for upper floors.
   8. Closure: Bronze plug with tapered threads.
   9. Adjustable Housing Material: Cast iron with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   11. Frame and Cover Shape: Round.
   12. Top Loading Classification: Heavy Duty.
   13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
   14. Vandal Proof screws

~~2.9~~2.8 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Fire stop Assemblies
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ProSet Systems Inc.
   2. Standard: UL 1479 assembly of sleeve and stack fitting with fire stopping plug.
   3. Size: Same as connected soil, waste, or vent stack.
   4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
   5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
   6. Special Coating: Corrosion resistant on interior of fittings.

~~2.10~~2.9 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Expansion Joints
   1. Standard: ASME A112.21.2M.
   2. Body: Cast iron with bronze sleeve, packing, and gland.
   3. End Connections: Matching connected piping.
   4. Size: Same as connected piping.

~~2.11~~2.10 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Applications: 12 oz./sq. ft..
   2. Vent Pipe Flashing: 8 oz./sq. ft..

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40 mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

~~2.12~~2.11 OVERFLOW DRAIN OUTLET COVER

A. Manufacturers: Subject to compliance with requirements, provide Zurn Z-199-DC or equal product by one of the following:
   1. Josam Company
   2. MIFAB, Inc.
   3. Smith, Jay R. Mfg. Co.
   4. Tyler Pipe; Wade Div.

B. Overflow drain outlet cover: ODC-1.
   1. Description: Round fabricated stainless steel frame with fabricated secured perforated stainless steel hinged strainer.
   2. Vandal proof secured top.

PART 3 EXECUTION

3.1 INSTALLATION

A. Refer to Section 220500 – Common Work Results for Plumbing for piping joining materials, joint construction, and basic installation requirements.

B. Install a backwater valve at the outlet of the subsoil drain discharge from the building. Locate the valve in a valve pit. Provide pit with airtight cover centered over backwater valve and of adequate size to access valve for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

G. Install through-penetration fire stop assemblies in plastic conductors and stacks at floor penetrations.

H. Install roof and overflow drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
   1. Install drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Position roof drains for easy access and maintenance.

I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

J. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

K. Install overflow drain outlet cover on overflow drains where they spill onto grade. Spill thru building wall at 10” above grade unless otherwise indicated on architects drawings.

L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
   2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 223400
FUEL FIRED DOMESTIC WATER HEATERS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Section 220500 – COMMON WORK RESULTS FOR PLUMBING.

B. Refer to General Commissioning Requirements on Section 019113

1.2 SUMMARY

A. This Section includes the following fuel-fired water heaters:
   1. Commercial, grid-type, finned-tube, gas-fired, domestic-water heaters.
   2. Expansion tanks.
   3. Water heater accessories.

B. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 01 8113 of this Specifications Manual.

1.3 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Furnish submittals as required in Section 018113-1.4 for all relevant materials in this section.

C. Shop Drawings: Diagram power, signal, and control wiring.

D. Product Certificates: For each type of commercial, gas fired water heater, signed by product manufacturer.

E. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Section 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT. Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Source quality-control test reports.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.

I. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to California Plumbing Code, and marked for intended use.

B. ASHRAE/IESNA 90.1-2004Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

C. ASME Compliance
   1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

B. Failures include, but are not limited to, the following:
   1. Structural failures including storage tank and supports.
   2. Faulty operation of controls.
   3. Deterioration of metals, metal finishes, and other materials beyond normal use.
   4. Warranty Period(s): From date of Substantial Completion
      a. Commercial, Finned-Tube, Gas Fired, Domestic Water Heaters
         1) Heat Exchanger: Three years.
         2) Controls and Other Components: Two years.
      b. Expansion Tanks: One year(s).

PART 2 PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE TYPE DOMESTIC-WATER HEATERS:

A. Commercial, Gas-Fired, Storage Domestic-Water Heaters.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Raypak
      b. Or Equal
   2. Description: Storage type gas water heater with seamless glasslined steel tank construction, with foam insulation, CSA Certified, ASME rated T&P relief valve and down fired power burner.
   3. Connections: Factory fabricated of materials compatible with heater. Attach to heater before testing.
      a. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      b. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
   4. Heater Appurtenances
      a. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
      b. Jacket: Steel with enameled finish.
      c. Burner: For use with grid-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
      d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, intermittent electronic-ignition system.

e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
f. Safety Control: Automatic, high-temperature-limit cutoff device or system.
g. With BMS interface

2.2 CAPACITY AND CHARACTERISTICS

A. Recovery: As indicated in equipment schedule at 90 deg F temperature rise.

B. Temperature Setting: 140 degrees F.

C. Fuel Gas Input: As indicated in equipment schedule.

D. Gas Pressure Regulator
1. Capacity: As indicated in equipment schedule.
2. Inlet Pressure: 0.7 inches water column.
3. Gas Pressure Required at Burner: 0.7 inches water column.

E. Electrical Characteristics
1. Volts: 120.
2. Phase: Single.
3. Hertz: 60.
4. Pump Hp: As indicated in equipment schedule.

F. Minimum Vent Diameter: As indicated in equipment schedule.

2.3 EXPANSION TANKSET-1, ET-2 . ADD-3:

A. Description: ASME code steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following.
a. AMTROL Inc.
b. Or Equal
2. Construction
a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.
3. Capacity and Characteristics
a. Working-Pressure Rating: 150 psig.
b. Maximum allowable temperature: 240 degree F
c. Capacity Acceptable: As indicated in equipment schedule.

2.4 WATER HEATER ACCESSORIES

A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

B. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

C. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

D. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial water heater and storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

D. Prepare test reports.

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
2. Concrete base construction requirements are specified in Section 220500 – COMMON WORK RESULTS FOR PLUMBING.
3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

B. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

D. Install seismic restraints for commercial water heaters. Anchor to substrate.

E. Install gas water heaters according to NFPA 54.

F. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.

G. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor sink.

H. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

I. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Section 221119 – DOMESTIC WATER PIPING SPECIALTIES for hose-end drain valves.

J. Install thermometer on outlet piping of water heaters. Refer to Section 220519 – METERS AND GAUGES FOR PLUMBING PIPING for thermometers.

K. Install pressure gauges on water heater outlet piping. Refer to Section 220519 – METERS AND GAUGES FOR PLUMBING PIPING for pressure gages.

L. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Section 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING for general-duty valves and to Section 220519 – METERS AND GAUGES FOR PLUMBING PIPING for thermometers.

M. Fill water heaters with water.

N. Charge expansion tanks with air.

O. Insulate hot water storage tank.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."

B. Comply with requirements for natural gas piping specified in Division 23 Section "Facility Natural Gas Piping."

C. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

F. Connect wiring according to Section 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train the University's maintenance personnel to adjust, operate, and maintain commercial, gas fired, domestic water heaters.

END OF SECTION

SECTION 230000
BASIC MECHANICAL REQUIREMENTS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This section includes information on the general requirements for work completed under Division 23.

B. Related Sections include the following:
   1. Section 230500 – COMMON WORK RESULTS FOR HVAC.
   2. Section 233113 – METAL DUCTS.
   3. Section 015719 – CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT.
   4. Section 019113 – COMMISSIONING REQUIREMENTS.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 DESCRIPTION OF WORK

A. The requirements of this Section apply to all Work of Division 23.

B. Provide a complete working installation with equipment called for in operational condition. Documents do not undertake to show or list every item to be provided. Provide items necessary for the complete operation of equipment and systems.

C. The scope of work shall include but shall not be limited to the following:
   1. Provide and install air-handling units; supply, exhaust and relief fans, packaged unit, VRF system air conditioning units, supply and exhaust air valves and air terminal units.
   2. Provide and install heating hot water central plant complete with boilers, pumps, expansion tanks, air separator, chemical pot feeder and accessories.
   3. Provide and install ductwork and air distribution devices to complete the HVAC supply, return, relief, make-up, outside and exhaust air systems.
   4. Provide and install water heater and boiler flue vent system complete with terminal exhaust fans.
   5. Provide and install heating hot water piping system that delivers heating hot water to supply air valves and air terminal unit heating coils complete with valving, supports and accessories.
   6. Provide and install refrigerant piping and accessories for the VRF system.
   7. Provide and install chilled water piping system to air handling units and chilled water fan coils complete with valving, supports and accessories, to 5 feet outside the building and connection to the campus utility distribution.
   8. Provide and install complete building management control system for air and water systems to match Campus standard.
   9. Provide and install seismic bracing and isolation necessary for HVAC equipment, piping and ductwork. Provide drawings and calculations stamped and signed by a structural engineer registered in the State of California.
   10. Provide testing, adjusting and balancing (TAB) for air and hydronic systems.

1.3 QUALITY ASSURANCE

A. Reference to technical societies, trade organizations, governmental agencies is made in this Division in accordance with the following abbreviations:
   1. AABC Associated Air Balance Council
   2. AGA American Gas Association
   3. AMCA Air Moving and Conditioning Association

4. ANSI American National Standards Institute
5. ASHRAE American Society of Heating, Refrigerating, and Air Conditioning Engineers
6. ASME American Society Mechanical Engineers
7. ASPE American society of Plumbing Engineers
8. ASSE American Society of Sanitary Engineering
9. ASTM American Society for Testing and Materials
10. AWWA American Water Works Association
11. CBC California Building Code
12. CCR California Code of Regulations
13. CEC California Electrical Code
14. CISPI Cast Iron Soil Pipe Institute
15. CMC California Mechanical Code
16. CPC California Plumbing Code
17. EPA Environmental Protection Agency
18. IAPMO International Association of Plumbing and Mechanical Officials
19. IEEE Institute of Electrical and Electronics Engineers
20. NEMA National Electrical Manufacturers' Association
21. NFPA National Fire Protection Association
22. OSHA Occupational Safety and Health Administration
23. SMACNA Sheet Metal and Air Conditioning Contractors National Association
24. UL Underwriters Laboratories, Inc.

B. Install work by craftsmen with minimum 10 years experience in the trade involved and by apprentices as indicated in the General Conditions.

C. Electrical Testing: Obtain the services of a qualified testing laboratory / agency to perform the specified field tests. Notify the Owner's Representative 24 hours in advance of performance of Work requiring testing. Provide materials required for testing. Refer to Division 26 for detailed requirements.

D. Factory and Field Testing
   1. See each section for the required testing and their procedures.
   2. Test reports shall include:
      a. Description of equipment tested.
      b. Description of test procedures.
      c. Test results.
      d. Names and signatures of witnesses of tests.

1.4 MATERIALS AND WORKMANSHIP

A. Contractor to provide fittings, transitions, dampers, valves and other devices required for a complete workable installation. Manufacturer's installation instructions shall be made available to the Owner's Representative.

B. Materials and adhesives used throughout the mechanical and plumbing systems shall have a flame spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives and the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50. "Flame Spread Rating" and "Smoke Developed Rating" shall be as determined by the "method of test of surface burning characteristics of building materials, NFPA No. 244, ASTM E84, Underwriters Laboratories, Inc., Standard". Such materials are listed in the Underwriters Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

1.5 TESTING EQUIPMENT BY CONTRACTORS AND MANUFACTURER'S REPRESENTATIVE

A. Equipment shall be installed in accordance with manufacturer's instructions. During construction request supervisory assistance from equipment manufacturer's representatives so the equipment will be correctly installed.

B. Have the manufacturer shall review the overall system design relative to the proper application of his equipment in the particular system. Have him/her note conduit, wiring, control, location, and other relevant relationships, and furnish appurtenances necessary for satisfactory operation.

C. Prior to final acceptance of work, submit to the Owner's Representative a signed statement by the manufacturer certifying to their inspection and the equipment is properly installed and ready for operation. Necessary permits shall have been obtained by the Contractor and submitted to and approved by the Owner's Representative.

1.6 LIST OF MATERIALS AND EQUIPMENT

A. Submit a List of Materials and Equipment in accordance with procedure in Division 1 to the Owner's Representative for approval of manufacturers of all materials and equipment proposed to be provided for this project.

B. The approval of the List of Material and Equipment shall be subject to submission and review of shop drawings.

1.7 SHOP DRAWINGS, SUBMITTALS

A. Submit as a minimum where applicable the following for all equipment for review. See individual sections for more requirements.

1. Manufacturer's drawings and performance data on all equipment.
2. Dimensioned drawings showing required openings.
3. Dimensioned drawings of equipment rooms, including exact equipment locations.
4. Dimensioned ductwork and piping installation drawings complete with elevations and fittings (1/4" = 1'-0" scale), or larger.
5. Equipment wiring diagrams.
6. Field installation diagrams.
7. Controls diagrams including diagrams and layout, software packages and control wiring diagrams.
8. "As-Built" drawings.

B. Conform to the following:

1. Submit complete submittals only.
2. Submit pertinent catalog and performance data sheets only.
3. Mark the exact equipment item and data on each sheet.
4. Contractor shall not submit entire catalogs.
5. Diagrams and drawings shall be submitted on sepia transparencies with required number of prints.

C. The Contractor shall prepare and furnish fully coordinated shop drawings showing ductwork and piping on separate drawings. The drawings shall be minimum 1/4" = 1'-0" scale and shall show dimensioning of piping and ductwork from gridlines, bottom of elevation marks for ductwork and piping and fittings, valves, dampers, devices, etc. with labels. In addition, the Contractor shall coordinate work specified in other sections. Any conflicts which occur shall be brought to the attention of the Owner's Representative prior to issuance of the Drawings. Refer to Division 01 of the Specifications for additional requirements.

D. When shop drawings are in the form of custom-prepared drawings, schedules or modified printed literature, they shall be prepared using an approved CAD (Computer Aided Drafting) system.

E. Shop drawings shall be required for all equipment and devices which are provided.

F. Submission shall be made in the form of a tab-indexed brochure. Index sheets shall be required for all material, including pipe, valves, insulation, conduit and wire as listed. Each submission shall be made under the Specifications Section Number it has been specified under.

G. Each group of material shall be submitted in tabulated form.

H. Incomplete submittals and submittals not in accordance with the above requirements shall be returned without action, and re-submittal shall be required.

I. Any corrections or modifications made by the Owner's Representative shall be deemed acceptable to the Contractor with no change in contract amount unless written notice complying with requirements specified in the General Conditions is received by the Owner's Representative prior to the performance of any work affected by any corrections or modifications.

J. No material or equipment shall be released for manufacture or shipment without first obtaining the Owner's Representative approved shop drawings.

K. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 01 8113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.8 SUBSTITUTIONS

A. Refer to Section 012513, PRODUCT SUBSTITUTION PROCEDURES.

B. Submit shop drawings and proposed products that differ from the scheduled or first named products and also indicate products with connections and show arrangements. Show necessary modifications of Architectural, structural, plumbing, fire protection, electrical and mechanical work required by the proposed products, including relocation of drains, revised electrical circuits, relocation of roof or wall penetrations, and revised foundations.

C. Accompany request for substitution review by table of comparison listing pertinent features of both first named and proposed materials including material of construction, overall length, width, height dimensions, space required for maintenance access, motor type, horsepower, voltage, phase service factor and noise levels. Review of proposed substitution will not be made until receipt of satisfactory comparison tabulation.

D. Limit submittal of substitutions to one proposal for each type or kind of items, unless otherwise permitted by the Owner. Substitution shall be limited to one per product, if first proposed product submittal is rejected, submit the first-named or scheduled product.

E. Review of drawings and other material submitted shall not be construed as a complete check or constitute a waiver of the requirements of the Contract Documents. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, and to effect necessary rearrangement or construction of other Work.

F. Any additional work required by other trades as a result of a substitution shall be covered under this Contract.

G. When a substitution is proposed, the Contractor shall be responsible to ensure that the performance and quality of the scheduled or specified equipment is met whether it requires additional accessories or not.

1.9 SHOP DRAWINGS, CHECKING

A. Before submitting shop drawings of equipment to the Owner's Representative, check them in detail to be sure that all requirements of the plans and specifications have been fully met. Review by the Owner's Representative of Shop Drawings does not release the Contractor from full compliance with the requirements of the plans and specifications when Shop Drawings deviate from these requirements.

B. Even though Shop Drawings have been stamped "Reviewed" and no exceptions have been taken by the Owner's Representative, the Contractor shall be fully responsible for all unauthorized deviations from the plans and specifications. Authorization for deviation will be made only by means of a letter from the Owner's Representative. The Owner's Representative's reviewed "No Exceptions Taken" stamp on a Shop Drawing is not an authorization for a deviation from the plans and specifications.

1.10 REGULATIONS AND CODES

A. Conform to all applicable code requirements.

B. Obtain the required permits from the local authorities for this work and pay for all fees required by the local, State, and Federal authorities for permits, inspections and review, including special agency construction and operating permits. Make corrections in the work as required by the Owner's Representative or Inspector to pass local regulations.

C. Provide Owner, Owner's Representative and local Inspectors access to work at all times.

D. Contractor shall be responsible for all law violations caused by the work under this Division. Notify Owner's Representative in writing when a discrepancy occurs between code requirements and work shown on drawings and resolve matter before proceeding with work.

E. Make application and pay for all certificates of inspection, taxes and permits required by Local, State or Federal Governments, public utilities, or other authorities having lawful jurisdiction. Deliver to the Owner's Representative any and all certificates of inspections, permits, and approvals which may be required by such authorities.

F. Refer to 014100 REGULATORY REQUIREMENTS.

1.11 COORDINATION OF ALL WORK

A. In accordance with General Conditions Paragraph 3.2, coordinate all work as necessary to achieve a complete neatly fitted installation for each condition. Consult the Drawings and Specifications to determine nature and extent of work specified in other Divisions which adjoins or attaches to the work of this Division. Confer with other Divisions at the site to coordinate this work with theirs in view of job conditions to the end that interferences may be eliminated and that maximum head room and clearance may be obtained. No additional compensation will be allowed for the moving of piping, ductwork, conduit or equipment to clear such interferences.

1.12 DRAWINGS

A. The drawings show the general arrangement of all piping, ductwork, conduit and equipment. Examine drawings and specifications very carefully, and notify the Owner's Representative by letter of any discrepancies so same can be rectified at an early date and prior to installation.

B. Should conditions necessitate any rearrangements, the Contractor shall prepare and submit drawings showing the changes before proceeding with the work. If such changes are approved, they shall become a part of this contract after their approval.

C. Due to the small scale of the drawings, it is not possible to show all offsets and every detail of construction. Additional fittings, valves, traps, vacuum breakers, ducts, etc. to complete the installation, shall be furnished and installed at no extra cost to the Owner.

D. The drawings are diagrammatic and are a graphic representation of the Contract Requirements, produced according to the best available standards to an optimum scale. Dimensions of work as indicated on plans are not guaranteed to be as-built dimensions. No measurements shall be scaled from the Drawings and used as a definite dimension for layout or fitting work in place.

E. The layout of equipment, as shown on the plans, shall be checked and exact location determined by dimensions of equipment accepted for installation. Consult the architectural and Structural Drawings for all dimensions, locations of partitions, sizes of structural members, foundations, etc.

F. The Contractor shall be responsible for the coordination of the mechanical ducting and piping distribution with the fire sprinklers, lighting, conduit, cable tray and structural members.

G. Duct dimensions shown on the drawings indicate the net inside clear dimension exclusive of any internal insulation or lining. All pipe sizes are nominal diameters.

1.13 LOCAL CONDITIONS

A. Prior to bidding visit the site and determine all existing conditions affecting work in this Division. Examine all Drawings and Specifications to familiarize with the type of construction to be used, and the nature and extent of work of other trades.

B. Observe the conditions under which deliveries of materials and equipment shall be made and under which such materials and equipment can be stored, and shall include adequate provision therefore in this proposal.

C. The location and elevation of the underground utilities, such as sewers, electrical power, water piping, conduit, etc., is as exact as can be determined from available information and its accuracy cannot be guaranteed. Exact location and elevation of these services shall be verified prior to excavation or installation of any portion of the work indicated. Exercise special care when excavating at or near the general location of underground utilities to avoid damage to the utility services, as well as to insure worker safety.

D. Any connections to or relocation of any existing utility line requiring temporary discontinuance of utility services which are in active use shall be scheduled and coordinated with the utility companies and the Owner's Representative. In no case shall the services be left disconnected at the end of a working day or weekend unless authorized by representatives of the utilities and the Owner. Any existing utility service damaged shall be repaired to the satisfaction of the Owner's Representative.

1.14 PROVISIONS FOR LATER INSTALLATIONS

A. Where any mechanical work cannot be installed as the work progresses, Contractor shall provide and arrange for the building in of boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Arrange for and lay out any chases, holes, or other openings which must be provided in masonry, concrete or other work.

1.15 MINOR DEVIATION

A. The dimensions and ratings of equipment herein specified or indicated on the Drawings are intended to establish the desired outlines and characteristics of such equipment. Minor deviations may be permitted after review by the Owner's Representative to allow manufacturers specified to bid on their nearest standard equipment.

B. Manufacturers catalog or model numbers and types mentioned in the Specifications or indicated on the drawings are intended to be used as guides and shall not be interpreted as taking precedence over specific ratings or duty called for or shown, which modify stipulations in such catalogs. In all cases, verify the duty specified with the particular characteristics of the equipment, and submit only items which comply with specification requirements.

1.16 HOIST, RIGGING, TRANSPORTATION AND SCAFFOLDING

A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for placing all materials and equipment in their proper places in the project. All temporary work shall be removed from the premises when its use is no longer required.

1.17 CUTTING AND PATCHING

A. Refer to Section 017219, CUTTING AND PATCHING.

1.18 PROTECTION

A. Refer to General Conditions Paragraph 10.2 and Section 016000, PRODUCT REQUIREMENTS.

1.19 FIELD VERIFICATION

A. Architectural plans will hold precedence over mechanical and electrical plans as to location of partitions, etc.

B. All roughing in construction dimensions shall be made from Architectural plans where discrepancies may exist.

1.20 ROOF OPENINGS AND CURBS

A. Roof Curbs: Prefabricated roof curbs shall be of the standard or sound attenuating type and shall be a minimum 12 inches high above finished roof surface.

B. Flashing and Counterflashing

1. Flashing around roof curbs shall be as detailed on the drawings. Counter-flashing shall be required on curbed openings and shall be 16 ounce CRC, except where counter-flashing is a component part of equipment (such as roof exhausters).

2. Openings passing through roof shall be made watertight by means of RPS, Pate Corp. or equal roof curbs and acrylic-coated ABS rib-reinforced plastic curb cover and EPDM protection rubber caps, complete with stainless steel, snap-lock swivel clamps.

1.21 ROOFTOP PIPE, DUCT AND EQUIPMENT SUPPORTS

A. Provide leak-proof equipment supports for roof mounted equipment, (except equipment specified to be supplied with integral or matching curb).

B. Supports shall be prefabricated of continuous welded 18 gauge minimum galvanized steel, 12 inches minimum height, mitered corner seams, integral cant and base plate, 2-inch by 4-inch fire resistant treated wood nailer, or 18 gauge counterflashing. Provide integral internal reinforcing necessary to support imposed load, but no less than 600 pounds per linear foot of perimeter.

C. Top surface shall be level. Provide base or special curbs where installed on pitched roof.

D. Install all roof piping and ductwork on supports as manufactured by Pate, Stiles or equal.

E. Pitch pans and pitch pockets shall not be allowed.

1.22 TOOLS AND EQUIPMENT

A. Furnish all tools and equipment necessary for the proper installation, protection and upkeep of the work.

1.23 EXPANSION AND CONTRACTION

A. Take all necessary precautions required to care for the contraction and expansion of all piping.

B. All piping shall be properly supported, guided, aligned and anchored for expansion and contraction.

C. Provide expansion loops or joints as required.

1.24 OPERATING AND MAINTENANCE MANUALS

A. General: Submit Operating and Maintenance Manual containing the following:

1. Startup and Shutdown Procedures: Submit a step-by-step write-up of all major equipment. When manufacturer's printed start-up, troubleshooting and shut-down procedures are available, they shall be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall include model number, capacities, and nameplate data.
    a. Service Instructions: Submit the following information for all pieces of equipment:
    b. Recommended spare parts, including catalog number and the name, address and telephone number of local suppliers of factory representative.
    c. Lubrication and maintenance instructions for all equipment including all electric motors.
4. Filter, belt sizes, types and lengths.
5. Detailed list of all control set points and control and wiring diagrams and software.
6. Testing and Commissioning Sheets detailing all set points, balance figures of air and water systems.
7. Include in the manuals, parts catalogs for each item of equipment furnished by him with the components identified by number of for replacement ordering.
8. All as-built drawings and wiring diagrams.
9. Valve charts organized on a room and sequence basis, detailing room, system and valve numbers.
10. Manual damper charts organized on a room and system basis, detailing room system and damper number.

B. Submission

C. Manuals shall be in triplicate, and all materials shall be bound into volumes of standard 8-1/2-inch x 11-inch size shall be separately bound or folded into brown envelopes, cross-referenced and indexed with the manuals.

D. The manuals shall include the name of the Architect, Contractor and major subcontractors.

E. In order not to duplicate Contractor's efforts, submit preliminary copy of the manual to the Owner's Representative for a pre-check; and when approved, Contractor shall then submit the final copies.

1.25 FIELD ADJUSTMENT TO AIR HANDLING EQUIPMENT AND FANS

A. Contractor shall be responsible to change or adjust belts, drives, pulleys, motors, impellers, as required by balancing company to achieve the desired air delivery by all air handling equipment.

1.26 RECORD DRAWINGS (AS-BUILTS)

A. In accordance with procedure in Division 1, and the following: indicate and transfer the record conditions as outlined above to the reproducible tracings.

B. Keep a day-to-day record of the installed locations for all equipment as hereinafter listed:
   1. All piping concealed in walls, floors, underground, or above inaccessible ceilings. Record need not include any exposed piping or piping above removable ceilings.
   2. Duct concealed in walls, underground or above inaccessible ceilings.
   3. Volume and fire dampers, smoke dampers and access panels both exposed and concealed.

C. Underground utility services, both inside and outside of buildings, shall be dimensioned from permanent structures or bend mark. Utility services outside of buildings shall also show depth of burial with reference to the finished ground floor elevation.

D. Immediately upon commencing work on the project, obtain a set of prints of the contract drawings pertaining to this branch of work. This set of drawings shall be kept on the project site at all times for use in recording "record" conditions.

E. The record drawings, as corrected and recorded by the Contractor, shall be submitted to the Owner's Representative for approval prior to authorization for final payment. Record drawings shall be certified as to their correctness by the signature of the Contractor and shall be stamped or otherwise identified as Record Drawings.

1.27 POLLUTANT CONTROL

A. Temporary Ventilation
   1. The permanent HVAC system shall only be used during construction if necessary to condition the building or area of addition or alteration within the required temperature range for material and equipment installation. If the HVAC system is used during construction, use return air filters with a minimum efficiency reporting value (MERV) of 8 based on ASHRAE 52.1-1992. Replace all filters immediately prior to occupancy, or, if the building is occupied during alteration, at the conclusion of construction.

B. Covering of duct openings and protection of mechanical equipment during construction
   1. At the time of rough installation and during storage on the construction site until final start-up of the heating, cooling and ventilating equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal or other methods acceptable to Owner's representative to reduce the amount of dust, water and debris which may enter the system.

1.28 FINISHING AND CLEANING

A. Clean premises of all excess construction material and debris caused by his work, in accordance with Section 017400, CLEANING AND WASTE MANAGEMENT.

B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish unless otherwise specified.

C. Clean exterior of piping, ductwork and equipment, exposed in complete structure. Remove rust, plaster and dirt by wire brushing; remove grease, oil and similar materials by wiping with clean rags and suitable solvents.

D. Motors, Pumps and Other Items with Factory Finish: Remove grease and oil and leave surfaces clean.

1.29 PAINTING

A. Preparation, priming and finish painting shall be in accordance with Section 099000 – PAINTING AND COATING. Except for the priming and painting work described below, all finish painting work shall be under Section 099000 – PAINTING AND COATING. Painting described below shall be part of the work of this Section.

B. Items to be painted: The following items and ferrous materials shall be "prime coated":

1. Sheet steel or structural steel supports, steel pipe, pipe hangers or supports, outside air volume and control dampers, screens, louvers, and machinery guards.
2. Supply and exhaust fans shall be factory primed.
3. Control cabinets, primed and finish coated prior to mounting controls and gauges.

C. The following items shall have the manufacturer's standard finish:

1. Cast iron valves and cast iron bases.
2. Supply, return and exhaust air diffusers and attached dampers.
3. Vibration mounts.
4. Combination Fire and Smoke, volume and control dampers in conditioned air.

D. Acceptance: Prior to finish painting and final acceptance by Owner’s Representative, touch up scratches or blemishes in prime coats and factory finishes.

1.30 FINAL INSPECTION

A. Refer to General Conditions and Division 1.

B. Each piece of equipment comprising part of the mechanical system shall be checked for proper lubrication, drive rotation, belt tension, control sequence and any other condition which may cause improper equipment operation, damage to equipment or endanger personnel.

1.31 PROJECT CLOSE-OUT

A. Refer to General Conditions Article 9 and Section 017800 – CLOSEOUT SUBMITTALS.

B. Deliver tools, spare parts, extra stocks of materials, and similar physical items to Owner.

C. Complete start-up, testing and demonstration of systems to the satisfaction of the Owner’s Representative that the entire installation is complete, properly adjusted and is in proper operating condition.

D. Complete final cleaning up requirements.

1.32 GUARANTEE TO REPAIR PERIOD

A. Refer to General Conditions Paragraph 12.2 for 2-year period.

B. Where appropriate, extended guarantee/warranty periods have been specified in individual sections. Refer to Section 017800 – CLOSEOUT SUBMITTALS, for warranty procedure and form.

C. Complete opposite season testing per Cx spec section 019113.

1.33 PRELIMINARY OPERATION AND EMERGENCY REPAIRS

A. Owner reserves the right to operate portions of the mechanical system on a preliminary basis or make emergency repairs without voiding the guarantee or relieving Contractor of its responsibilities.

1.34 SERVICES

A. General: Perform service on all mechanical Work until acceptance of the Work including oiling and greasing, adjustments, cleaning, packing of seals, and other items as recommended by equipment manufacturer in the maintenance manual hereinbefore specified.

B. Air Filters

1. Do not operate air-moving equipment having air filters unless temporary filters, of equal rating to specified, are in place to protect the mechanical Work.
2. Replace these temporary filters with specified filters before final test and balance work is begun as necessary for accurate readings. After completing the testing and balancing work, replace filters with new filter media as specified.

C. Replace insulation removed or damaged after each operation.

D. Put system in full operating condition.

1.35 WARRANTIES

A. The warranty period shall be no less than two (2) full years, unless specified otherwise hereinafter.

B. During the warranty period, the contractor shall guarantee the following in a form satisfactory to the Owner:

1. All Work installed will be free from any and all defects in Workmanship and/or materials.
2. All equipment, apparatus will develop capacities and performance characteristics specified.
3. The systems shall operate without malfunction.

C. The contractor shall, without cost to the Owner, remedy any defects within a reasonable time to be specified in notice from the Architect. In default thereof, the Owner may have such Work done and charge all costs to the Subcontractor.

D. The start of the contractor's warranty period, as defined in the General Conditions, shall commence on the issue of a "Certificate of ~~Substantial~~ Final Completion", by the Owner or the Owner's Representative for each item of material, equipment or system. **ADD-3**

E. All required extended warranty costs for equipment, materials and systems shall be included in the contractor's proposal.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 230519
METERS AND GAGES FOR HVAC PIPING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Thermometers
   2. Gages
   3. Test Plugs
   4. Flowmeters

B. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

D. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.3 WARRANTY

A. Manufacturer agrees to repair or replace device that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years from date of ~~Substantial~~ final completion. **ADD-3**

PART 2 PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Provide product by one of the following:
   1. Trerice, H. O. Co.
   2. Marsh Bellofram.
   3. Weiss Instruments, Inc.
   4. Or equal.

B. Standard: ASME B40.200.

C. Case: Die-cast aluminum or Chrome-plated brass, 9-inch long.

D. Tube: Mercury or red or blue organic-liquid filled, with magnifying lens.

E. Tube Background: Satin-faced, non-reflective aluminum with permanently etched scale markings.

F. Window: Plastic.

G. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

H. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

I. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

A. Provide product by one of the following:
   1. Trerice, H. O. Co.
   2. Marsh Bellofram.
   3. Weiss Instruments, Inc.
   4. Or equal.

B. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.

C. Element: Phosphor Bronze bourdon tube or other type of pressure element.

D. Movement: Mechanical, connecting element and pointer.

E. Dial: Satin-faced, non-reflective aluminum with permanently etched scale markings.

F. Pointer: Red metal.

G. Window: Glass.

H. Ring: Close type, Stainless steel.

I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

J. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Provide product by one of the following:
   1. Trerice, H. O. Co.
   2. Marsh Bellofram.
   3. Weiss Instruments, Inc.
   4. Or equal.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.5 PRESSURE GAGES

A. Provide product by one of the following:
   1. Trerice, H. O. Co.
   2. Marsh Bellofram.
   3. Weiss Instruments, Inc.
   4. Or equal.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
   1. Case: Liquid Filled, drawn steel or cast aluminum, 4-1/2-inch diameter.
   2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
   3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
   4. Movement: Mechanical, with link to pressure element and connection to pointer.

5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.
12. Pressure Rating: 300 psig at 200 deg F.

C. Pressure-Gage Fittings
1. Valves: NPS 1/4 stainless-steel needle type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.6 TEST PLUGS

A. Provide product by one of the following:
1. Trerice, H. O. Co.
2. Flow Design, Inc.
3. Sisco Manufacturing Co.
4. Watts Industries, Inc.; Water Products Div.
5. Or equal.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air and water service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

E. Test Kit: Furnish one test kit containing one pressure gage and adaptor, two thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 250 deg F.
3. Carrying case shall have formed instrument padding.

2.7 ULTRASONIC FLOWMETERS:

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Eastech Badger, Inc. (Vantage 4000)
2. Siemens (Sitrans FUS1010).
3. General Electric (AquaTrans AT868)
4. Engineering Measurements Company (Sono-Trak Transit Time Ultrasonic)
5. Or equal.

B. Pressure Rating: 150 psig.

C. Temperature Rating: 180 deg F minimum.

D. Description: Meter with flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.

E. Flow Sensor: Transit-time, externally mounted, clamp-on, ultrasonic type with transmitter.

F. Temperature Sensors: Insertion-type or strap-on transducer.

G. Indicator: Solid-state, integrating-type meter with integral battery pack.

1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
2. Battery Pack: Five-year lithium battery.

H. Select either 1 percent or 5 percent accuracy below depending on project requirements. Note that the GE AquaTrans cannot achieve ±1 percent with a clamp on type sensor and will need to be removed from the listed manufacturers if ±1 percent is selected.

I. Accuracy: Plus or minus 1 percent of actual flow.

J. Turn-down: 400:1.

K. Repeatability: 0.25 percent.

L. Display: Visually indicates instantaneous rate of flow with register to indicate total fluid volume in gallons and thermal-energy flow in British thermal units.

M. Strainer: Full size of main line piping.

N. Outputs: Min. one 4-20 mA isolation circuit. Output connections to be compatible with EMCS.

O. Provide Analogue Output for connection to Energy Management Control System for flow totalization.

2.8 TURBINE FLOWMETERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eastech Badger, Inc.
2. Bailey-Fischer & Porter Co.
3. Data Industrial Corp.
4. ONICON Incorporated.
5. Or equal.

B. Description: Insertion type for inserting turbine into piping and measuring flow directly in gallons per minute.

C. Construction: Bronze or stainless-steel body; with plastic turbine or impeller and integral direct-reading scale.

D. Pressure Rating: 150 psig.

E. Temperature Rating: 180 deg F minimum.

F. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons.

G. Accuracy: Plus or minus 2-1/2 percent.

H. Provide Analogue Output for connection to Energy Management Control System for flow totalization.

PART 3 EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations, and where indicated on the drawings:

1. Inlet and outlet of each boiler.
2. Outside-air, return-air and mixed-air ducts.

B. Install direct-mounting, vapor-actuated dial thermometers in the following locations, and where indicated on the drawings:

1. Inlet and outlet of each hydronic coil in air-handling units or built-up central systems.
2. Inlet and outlet of all hydronic lines entering and leaving mechanical rooms.
3. Heating hot water supply and return mains into the building.

C. Install dry liquid-filled-case-type, vapor-actuated dial thermometers at suction and discharge of each pump.

D. Provide the following temperature ranges for thermometers:
   1. Heating Hot Water: 30 to 240 degrees F, with 2-degree scale divisions.
   2. Chilled Water: 0 to 100 degrees F, with 2-degree scale divisions.
   3. Air Ducts: 30 to 120 degrees F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install liquid filled type pressure gages for discharge of each pressure-reducing valve.

B. Install liquid filled type pressure gages at chilled water lines entering and leaving the building.

C. Install liquid filled type pressure gages at suction and discharge of each pump, installing taps before strainers and on suction and discharge of pump.

3.3 METER APPLICATIONS

A. Install ultrasonic flow meter on chilled and hot water system prior to leaving mechanical room.

B. Install turbine flow meters on make-up water connection to hot water system.

3.4 INSTALLATIONS

A. Provide thermowells for each thermometer. The thermowells shall be selected for each gauge bulb and shall be 1/2-inch NPT. Enlarge pipes smaller than 2-1/2 inch for a length of 12 inches for installation of thermowells

B. Provide and select bulbs suitable for service pressure.

C. Install direct-mounting thermometers and adjust vertical and tilted positions. Make sure the thermometers are installed upright for easy reading.

D. Install thermowells adjacent to controls system thermostat, transmitter, or sensor sockets.

E. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

F. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

G. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position. Make sure the gages are installed upright for easy reading.

H. Install pressure gages with pulsation dampers.

I. Install needle-valve and snubber fitting in piping for each pressure gage for fluids.

J. Install test plugs in tees in piping.

K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.

L. Install flowmeter elements in accessible positions in piping systems.

M. Install flowmeter elements with at least minimum straight lengths of 10 pipe diameters upstream and minimum 5 pipe diameters downstream from element or as prescribed by manufacturer's written instructions.

N. Install permanent indicators on walls or brackets in accessible and readable positions.

O. Install connection fittings for attachment to portable indicators in accessible locations.

P. Mount meters on wall if accessible; if not, provide brackets to support meters.

Q. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

3.5 CONNECTIONS

A. Install thermometers, gages and meters adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters and building control system.

3.6 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of thermometers and gages to proper angle for best visibility. Make sure the thermometers and gages are installed upright for easy reading.

END OF SECTION

SECTION 230523
GENERAL DUTY VALVES FOR HVAC PIPING

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Bronze ball valves.
   2. Bronze lift check valves.
   3. Bronze swing check valves.
   4. Iron, single-flange butterfly valves.
   5. Iron, grooved-end butterfly valves.
   6. Iron, grooved-end swing-check valves.
   7. Iron swing check valves with closure controls.
   8. Chainwheels.

B. Related Sections
   1. Section 230553"IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT " for valve tags and schedules.
   2. Section 230923 – INSTRUMENTATION AND CONTROL FOR HVAC FOR CONTROL VALVES AND ACTUATORS.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

B. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.4 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.1 for power piping valves.
   3. ASME B31.9 for building services piping valves.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Set butterfly valves closed or slightly open.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.6 WARRANTY

A. Manufacturer agrees to repair or replace valve that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of ~~Substantial~~ final completion. **ADD-3**

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types

1. Handlever: For quarter-turn valves NPS 6 and smaller.
2. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Threaded: With threads according to ASME B1.20.1.
3. Grooved: With grooves according to AWWA C606.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim

1. Manufacturers:
   a. NIBCO T-585-Y-70-66.
   b. Hammond.
   c. Or equal.
2. Description
   a. Standard: MSS SP-110.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE or TFE.

g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic Disc
1. Manufacturers:
a. NIBCO T-480-Y
b. Hammond Valve
c. Or equal.
2. Description
a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE, or TFE.

2.4 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Nonmetallic Disc
1. Manufacturers:
a. NIBCO T-433-Y
b. Hammond Valve
c. Or equal.
2. Description
a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc
1. Manufacturers:
a. NIBCO LD-3022
b. Hammond Valve
c. Or equal.
2. Description
a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.6 IRON, GROOVED-END BUTTERFLY VALVES

A. 300 CWP, Iron, Grooved-End Butterfly Valves
1. Manufacturers:
a. Victaulic Company, VIC-300 Masterseal.
b. Or equal.
2. Description
a. Standard: MSS SP-67, Type I.
b. CWP Rating: 300 psig.

c. Body Material: Coated, ductile iron.
d. Stem: Two-piece stainless steel.
e. Disc: Aluminum Bronze or Stainless Steel.
f. Seal: EPDM.

2.7 IRON, GROOVED-END SWING CHECK VALVES

A. 250 CWP, Iron, Grooved-End Swing Check Valves
   1. Manufacturers:
      a. NIBCO GD-920-W
      b. Anvil International, Inc.
      c. Shurjoint Piping Products
      d. Victaulic Company
      e. Or equal.
   2. Description
      a. CWP Rating: 250 psig.
      b. Body Material: ASTM A 536, ductile iron.
      c. Seal: EPDM or Buna-N.
      d. Disc: Spring operated, ductile iron or stainless steel.

2.8 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control
   1. Manufacturers:
      a. NIBCO F-918-BLW.
      b. Hammond Valve.
      c. Milwaukee Valve Company.
      d. Or equal.
   2. Description:
      a. Standard: MSS SP-71, Type I.
      b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
      c. Body Design: Clear or full waterway.
      d. Body Material: ASTM A 126, gray iron with bolted bonnet.
      e. Ends: Flanged.
      f. Trim: Bronze.
      g. Gasket: Asbestos free.
      h. Closure Control: Factory-installed, exterior lever and weight.

2.9 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Babbitt Steam Specialty Co.
   2. Roto Hammer Industries
   3. Trumbull Industries.
   4. Or equal.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to butterfly valve stems.
   3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
   4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Provide 3/4-inch ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest drain.

F. Install chainwheels on operators for butterfly, gate and globe valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

G. Equipment with automatic control valves shall have isolation valves installed either ahead or behind the control valve, to permit removal of the control valve from the line without draining the system.

H. Line valves 4 inches and above shall be supported at valve in addition to regularly spaced pipe supports.

I. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Lift Check Valves: With stem upright and plumb.

J. When valves are installed above ceilings accessible through an access panel, locate valve not more than 2.5 feet from the access panel opening sized 24”x 24” and install valves directly above an access panels smaller than 24”x24”. This does not apply to valves provided with chainwheels.

3.3 JOINT CONSTRUCTION

A. Refer to Section 230500 – COMMON WORK RESULTS FOR HVAC for basic piping joint construction.

B. Refer to Section 232113 – HYDRONIC PIPING for piping application.

C. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.4 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.5 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or butterfly valves.
   2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
   3. Pump-Discharge Check Valves
      a. NPS 2-1/2 and Smaller: Bronze swing check valves with nonmetallic disc.

b. NPS 3 and Larger: Iron swing check valves with lever and weight, resilient-seat check valves.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:
1. For Copper Tubing, NPS 2-1/2 and Smaller: Threaded ends.
2. For Steel Piping, NPS 3 and Larger: Flanged ends.
3. For Grooved-End Copper Tubing and Steel Piping, valve ends may be grooved.

3.6 CHILLED WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller
1. Bronze Ball Valves: Two-piece, full port, with stainless-steel trim.
2. Bronze Swing Check Valves: Class 150, non-metallic disc.

B. Pipe NPS 2-1/2 and Larger
1. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, NBR seat, stainless-steel disc.
2. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 300 CWP.
3. Iron Swing Check Valves with Closure Control, NPS 3 to NPS 12: Class 125, lever and spring or weight.
4. Iron, Grooved-End Check Valves, NPS 2-1/2 to NPS 12: 250 CWP.

3.7 HEATING HOT WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller
1. Bronze Ball Valves: Two-piece, full port, with stainless-steel trim.
2. Bronze Swing Check Valves: Class 150, nonmetallic disc.

B. Pipe NPS 3 and Larger
1. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, NBR seat, stainless-steel disc.
2. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 300 CWP.
3. Iron Swing Check Valves with Closure Control, NPS 3 to NPS 12: Class 125, lever and spring or weight.
4. Iron, Grooved-End Check Valves, NPS 2-1/2 to NPS 12: 250 CWP.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING AND BALANCING FOR HVAC

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Balancing Air Systems
      a. Constant-air volume systems.
      b. Variable-air-volume systems.
   2. Balancing Hydronic Piping Systems
      a. Constant-flow hydronic systems.
      b. Variable-flow hydronic systems.
   3. Sound measurement of equipment operating conditions.
   4. Vibration measurement of equipment operating conditions.
   5. Domestic Hot Water System

B. See Commissioning Requirements Section 019113.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council

B. TAB: Testing, Adjusting, and Balancing

C. TABB: Testing, Adjusting, and Balancing Bureau

D. TAB Contractor: An entity engaged to perform TAB Work

1.3 ACTION SUBMITTALS

A. LEED Submittals
   1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
   1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
   2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. TAB Conference: Meet with Owner's Representative on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Allow for seven days advance notice of scheduled meeting time and location.
   1. Agenda Items
      a. The Contract Documents examination report.
      b. The TAB plan.
      c. Coordination and cooperation of trades and subcontractors.
      d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Owner's Representative.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before ~~Substantial~~ Final Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations. **ADD-3**

1.7 COORDINATION

A. Notice: Allow for seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.0 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

B. Install identification after insulation and painting of materials is completed.

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 METAL DUCTS and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Provide a written report to CxA or Construction Manager for deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Submit written report to CxA or Construction Manager. Verify the following:
   1. Permanent electrical-power wiring is complete.
   2. Automatic temperature-control systems are operational.
   3. Equipment and duct access doors are securely closed.
   4. Balance, smoke, and fire dampers are open.
   5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing, adjusting and balancing procedures on each system after leakage and pressure tests on air and water distribution systems have been satisfactorily completed. HVAC systems testing and balancing shall be in accordance with the following:
   1. AABC's "National Standards for Testing and Balancing Heating, Ventilating and Air conditiong System", latest edition.
   2. ASHRAE HVAC Applications Manual, 2007, Chapter 37 Testing, Adjusting and Balancing.
   3. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "AIR DUCT ACCESSORIES."
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230700 "HVAC INSULATION."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "METAL DUCTS."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
   2. Measure fan static pressures as follows to determine actual static pressure:
      a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
      a. Report the cleanliness status of filters and the time static pressures are measured.
   4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
   5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   6. Obtain approval from Owner’s Representative for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of submain and branch ducts.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
   3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
   1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-VOLUME AIR SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
   1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
   2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
   3. Measure total system airflow. Adjust to within indicated airflow.
   4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
   5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
      a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
   6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
      a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Efficiency rating.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check makeup water-station pressure gage for adequate pressure for highest vent.
   3. Check flow-control valves for specified sequence of operation, and set at indicated flow.
   4. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
   5. Set system controls so automatic valves are wide open to heat exchangers.
   6. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
   7. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
   1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
      a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Owner’s Representative and comply with requirements in Section 232123, HYDRONIC PUMPS.
   2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
      a. Monitor motor performance during procedures and do not operate motors in overload conditions.
   3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
   4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated pre-settings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.11 PROCEDURE FOR SOUND LEVEL MEASUREMENTS

A. Perform sound-pressure-level measurements with an octave-band analyzer complying with ANSI S1.4 for Type 1 sound-level meters and ANSI S1.11 for octave-band filters. Comply with requirements in ANSI S1.13, unless otherwise indicated.

B. Calibrate sound meters before each day of testing. Use a calibrator provided with the sound meter complying with ANSI S1.40 and that has NIST certification.

C. Use a microphone that is suitable for the type of sound levels measured. For areas where air velocities exceed 100 fpm, use a windscreen on the microphone.

D. Perform sound-level testing after air and water balancing and equipment testing are complete.

E. Close windows and doors to the space.

F. Perform measurements when the space is not occupied and when the occupant noise level from other spaces in the building and outside are at a minimum.

G. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.

H. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, and other large surface capable of altering the measurements.

I. Take sound measurements in dBA and in each of the 8 unweighted octave bands in the frequency range of 63 to 8000 Hz.

J. Take sound measurements with the HVAC systems off to establish the background sound levels and take sound measurements with the HVAC systems operating. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.

3.12 PROCEDURE FOR VIBRATION MEASUREMENTS

A. Use a vibration meter meeting the following criteria
   1. Solid-state circuitry with a piezoelectric accelerometer.

2. Velocity range of 0.1 to 10 inches per second.
3. Displacement range of 1 to 100 mils.
4. Frequency range of at least 0 to 1000 Hz.
5. Capable of filtering unwanted frequencies.

B. Calibrate the vibration meter before each day of testing.
   1. Use a calibrator provided with the vibration meter.
   2. Follow vibration meter and calibrator manufacturer's calibration procedures.

C. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.
   1. Turn off equipment in the building that might interfere with testing.
   2. Clear the space of people.

D. Perform vibration measurements after air and water balancing and equipment testing is complete.

E. Clean equipment surfaces in contact with the vibration transducer.

F. Position the vibration transducer according to manufacturer's written instructions and to avoid interference with the operation of the equipment being tested.

G. Measure and record vibration on rotating equipment over 3 hp.

H. Measure and record equipment vibration, bearing vibration, equipment base vibration, and building structure vibration. Record velocity and displacement readings in the horizontal, vertical, and axial planes.
   1. Fans and HVAC Equipment with Fans
      a. Fan Bearing: Drive end and opposite end.
      b. Motor Bearing: Drive end and opposite end.
      c. Equipment Casing: Top and side.
   2. Equipment Base: Top and side.
      a. Building: Floor.
      b. Ductwork: To and from equipment after flexible connections.
      c. Piping: To and from equipment after flexible connections.

I. For equipment with vibration isolation, take floor measurements with the vibration isolation blocked solid to the floor and with the vibration isolation floating. Calculate and report the differences.

J. Inspect, measure, and record vibration isolation.
   1. Verify that vibration isolation is installed in the required locations.
   2. Verify that installation is level and plumb.
   3. Verify that isolators are properly anchored.
   4. For spring isolators, measure the compressed spring height, the spring OD, and the travel-to-solid distance.
   5. Measure the operating clearance between each inertia base and the floor or concrete base below. Verify that there is unobstructed clearance between the bottom of the inertia base and the floor.

3.13 PROCEDURE FOR DOMESTIC HOT WATER SYSTEM

A. Refer to P0.01, CALGREEN Notes for Testing and Adjusting of Water Heating System.

3.14 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
   2. General Air Outlets and Inlets: Plus or minus 10 percent.
   3. Laboratory Air Outlets and Inlets: Plus or minus 5 percent.
   4. Heating-Water Flow Rate: Plus or minus 5 percent.
   5. Chilled-Water Flow Rate: Plus or minus 5 percent.
   6. Domestic Hot Water System Flow Rate: Plus or minus 5 percent.

3.15 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.16 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
   12. Description of system operation sequence if it varies from the Contract Documents.
   13. Nomenclature sheets for each item of equipment.
   14. Data for terminal units, including manufacturer's name, type, size, and fittings.
   15. Notes to explain why certain final data in the body of reports vary from indicated values.
   16. Test conditions for fans performance forms including the following:
      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable-air-volume systems.
      g. Settings for supply-air, static-pressure controller.
      h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Water flow rates.
   3. Duct, outlet, and inlet sizes.

4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
      f. Unit arrangement and class.
      g. Discharge arrangement.
      h. Sheave make, size in inches, and bore.
      i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
      j. Number, make, and size of belts.
      k. Number, type, and size of filters.
   2. Motor Data
      a. Motor make, and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches, and bore.
      f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   3. Test Data (Indicated and Actual Values)
      a. Total air flow rate in cfm.
      b. Total system static pressure in inches wg.
      c. Fan rpm.
      d. Discharge static pressure in inches wg.
      e. Filter static-pressure differential in inches wg.
      f. Heating-coil static-pressure differential in inches wg.
      g. Outdoor airflow in cfm).
      h. Outdoor-air damper position.

F. Apparatus-Coil Test Reports
   1. Coil Data
      a. System identification.
      b. Location.
      c. Coil type.
      d. Number of rows.
      e. Fin spacing in fins per inch o.c.
      f. Make and model number.
      g. Face area in sq. ft.
      h. Tube size in NPS.
      i. Tube and fin materials.
      j. Circuiting arrangement.
   2. Test Data (Indicated and Actual Values)
      a. Air flow rate in cfm.
      b. Average face velocity in fpm.
      c. Air pressure drop in inches wg.
      d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
      e. Entering-air, wet- and dry-bulb temperatures in deg F.
      f. Leaving-air, wet- and dry-bulb temperatures in deg F.

G. Fan Test Reports: For supply and exhaust fans, include the following:
   1. Fan Data
      a. System identification.
      b. Location.
      c. Make and type.

d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values)
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. Air-Terminal-Device Reports

1. Unit Data
a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values)
a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data
a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.

d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values)
   a. Air flow rate in cfm.
   b. Entering-water temperature in deg F.
   c. Leaving-water temperature in deg F.
   d. Water pressure drop in feet of head or psig.
   e. Entering-air temperature in deg F.
   f. Leaving-air temperature in deg F.

K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data
   a. Unit identification.
   b. Location.
   c. Service.
   d. Make and size.
   e. Model number and serial number.
   f. Water flow rate in gpm.
   g. Water pressure differential in feet of head or psig.
   h. Required net positive suction head in feet of head or psig.
   i. Pump rpm.
   j. Impeller diameter in inches.
   k. Motor make and frame size.
   l. Motor horsepower and rpm.
   m. Voltage at each connection.
   n. Amperage for each phase.
   o. Full-load amperage and service factor.
   p. Seal type.
2. Test Data (Indicated and Actual Values)
   a. Static head in feet of head or psig.
   b. Pump shutoff pressure in feet of head or psig.
   c. Actual impeller size in inches.
   d. Full-open flow rate in gpm.
   e. Full-open pressure in feet of head or psig.
   f. Final discharge pressure in feet of head or psig.
   g. Final suction pressure in feet of head or psig.
   h. Final total pressure in feet of head or psig.
   i. Final water flow rate in gpm.
   j. Voltage at each connection.
   k. Amperage for each phase.

L. Instrument Calibration Reports

1. Report Data
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

M. Vibration Measurement Reports

1. Date and time of test.
2. Vibration meter manufacturer, model number, and serial number.
3. Equipment designation, location, equipment, speed, motor speed, and motor horsepower.
4. Diagram of equipment showing the vibration measurement locations.
5. Measurement readings for each measurement location.
6. Calculate isolator efficiency using measurements taken.
7. Description of predominant vibration source.

N. Sound Measurement Reports: Record sound measurements on octave band and dBA test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms

1. Date and time of test. Record each tested location on its own NC curve.
2. Sound meter manufacturer, model number, and serial number.
3. Space location within the building including floor level and room number.
4. Diagram or color photograph of the space showing the measurement location.
5. Time weighting of measurements, either fast or slow.
6. Description of the measured sound: steady, transient, or tonal.
7. Description of predominant sound source.

3.17 INSPECTIONS

A. Initial Inspection

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
   a. Measure airflow of at least 20 percent of air outlets.
   b. Measure water flow of at least 10 percent of terminals.
   c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
   d. Verify that balancing devices are marked with final balance position.
   e. Note deviations from the Contract Documents in the final report.

B. Final Inspection

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner's Representative.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner's Representative.
3. Owner's Representative shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

D. Prepare test and inspection reports.

E. After report is submitted, the TAB contractor's test and balance engineer shall conduct TAB verification up to 20% of test values with the CxA.

3.18 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 230923
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Work in this section includes instrumentation and control devices, include sensors, valves, actuators, and other equipment and accessories necessary to operate a complete DDC system.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

D. See Commissioning Requirements 019113.

1.2 DEFINITIONS

A. EMCS: Energy Management Control System

B. DDC: Direct digital control.

C. I/O: Input/output.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

1.3 RTD: RESISTANCE TEMPERATURE DETECTOR

A. This specification section defines the minimum requirements for control instrument and devices for a Direct Digital Control (DDC) and Energy Management Control System (EMCS).

B. Work in this section includes furnishing and installing all field devices, including electronic sensors for DDC controls, meters, actuators for motorized control valves and dampers, and all related field wiring, interlocking control wiring between equipment to constitute a complete Energy Management Control System (EMCS).

C. Provide instrument and control devices for the fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control. The installation of the control system shall be performed under the direct supervision of the control manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer.

D. All materials and equipment used shall be standard components, regularly manufacture for the specified use and not custom designed especially for this project. All systems components shall have been thoroughly tested and proven in actual use for at least three years.

E. Provide all Energy Management Control System (EMCS) and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all applicable code requirements. All wiring shall be in conduit.

1.4 REFERENCE

A. UL 873 Temperature (and Airflow) indicating Equipment

1.5 ACTION SUBMITTALS

A. Product Data: Include manufacturer's data sheets indicating model number, pressure / temperature ratings, capacity, accuracy, methods and materials of construction, installation instruction, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless other specific model is clearly marked.

1. Submit manufacturer's specification for each control device furnished, including installation instructions and startup instructions. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.
2. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
3. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
4. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Certificate of calibration and instruction for filed calibration in compliance with Title 24 requirements.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Schematic flow diagram of system show air handling unit, fans, fan coil units, dampers, valves, and other control devices.
   a. Label each device with setting or adjustable range of control.
   b. Indicate all wiring, clearly differentiating between factory and filed installed wiring.
   c. Wiring diagrams shown in schematics shall detail contact states, relay references, etc.
2. Submit details of construction, layout, and location of each space control device (e.g. thermostat, humidistat, CO2 sensor) within the building, including instruments location in the panel and labeling.
   a. Indicate which piece of mechanical equipment is associated with each device and what area within the building is being served by that equipment.
   b. For terminal unit control, provide a room schedule that would list mechanical equipment tag, room number of space serviced, address of DDC controller, and any other pertinent information required for service.
3. Schedule of control valves indicating the following:
   a. The system in where the device is to be used, rated capacity, flow coefficient, flow required by device served, actual pressure drop at design flow, size of operator required, close-off pressure, and locations where valves are to be installed.
4. Wiring diagram for each electrical control device along with other details required to demonstrate that the system has been coordinated and will function as required.

D. LEED Submittal

1. Achievement of LEED-CI v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.6 INFORMATIONAL SUBMITTALS

A. Data Communications Protocol Certificates.

B. Qualification Data: For manufacturer.

C. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

D. Field quality-control test reports.

E. Annotated software program documentation shall be submitted for system sequence, along with descriptive narratives of the sequence of operation of the entire system involved.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals.
   1. Maintenance instructions and lists of spare parts for each type of control device.
   2. Interconnection wiring diagrams with identified and numbered system components and devices.
   3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
   4. Calibration records and list of set points.

B. Submit record drawings to incorporate the EMCS and electric field work.
   1. Revise shop drawings to reflect actual installation. Record actual location of control components, including control units, thermostats, and sensors
   2. Device address list.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Replacement Materials: One replacement diaphragm or relay mechanism for each unique thermostat and positioning relay.
   2. Maintenance Materials: One thermostat adjusting key(s).
   3. One (1) sensor of each type
   4. Two zone thermostats and unit controllers.

1.9 COMMISSIONING

A. Division 23 will be responsible to carry out the Commissioning Requirements specified in 019100 – COMMISSIONING and 230800 COMMISSIONING OF HVAC.

B. Furnish services to completely commission, test and verify the control system and all sensing and monitoring devices including time for on-site services by a control system technician to complete the commissioning scope of work. Control system commissioning shall be coordinated with the Owner's commissioning activities and Owner's DDC group.

1.10 QUALIFICATION

A. All control equipment and devices shall be supplied by a company specialized in manufacture of the control equipment and devices of the specified application for at least five years and have proof installation history in the direct digital control system of similar size and complexity as this project.

1.11 QUALITY ASSURANCE

A. Use only UL labeled products that comply with NEMA standards. Electrical components and installation to meet all requirements of electrical specifications of Division 26.

B. Provide devices exposed to outside ambient conditions with weather protection or construct them so that they are suitable for outdoor installation.

C. Provide control devices subject to corrosive environments with corrosion protection or construct them so that they are suitable for use in such environment.

1.12 WARRANTY

A. Manufacturer agrees to repair or replace device that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years from date of ~~Substantial~~ Final completion. **ADD-3**

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

C. Furnish two major inspections at 6-month intervals and two minor inspections offset equally between the two major inspections. Schedule major inspections in Summer and Winter. Minor inspections shall include visual checks and operational tests of all equipment delivered. Major inspections shall include all work described for minor inspections and the following work:
   1. Clean all equipment, including interior and exterior surfaces.
   2. Perform signal, voltage and system isolation checks of system workstation and peripherals.
   3. Check and calibrate each filed device. Check all analog points and digital points.
   4. Run all diagnostics and correct all previously diagnosed problems.
   5. Resolve and correct any previous outstanding problems.

D. Emergency Service: Owner will initiate service call when the system is not functioning properly. Furnish the Owner's Representative with the telephone number where service personnel shall be at the building site next business day after receiving a request for service.

1.13 DELIVERY, STORAGE AND HANDLING

A. All handling and storage procedures shall be per manufacturer's recommendation

B. Control devices shall be kept clean and dry, protected from all damage, including that due to weather and construction traffic.

PART 2 PRODUCTS

2.1 SENSORS AND TRANSMITTERS

A. General
   1. All sensors etc. shall be able to communicate with EMCS for control, monitoring, and report.

B. Manufacturers (except where noted)
   1. Vaisala.
   2. Onicon.
   3. Ebtron.
   4. Or equal.

C. Temperature Sensor (all public spaces)
   1. Platinum or nickel RTD, have a base resistance of 1000 ohm at 70 degrees F. 100 ohm platinum RTD are acceptable if used with temperature transmitters.
   2. Thermistor shall be 10,000 ohm.
   3. Outside air sensors shall be shielded from solar radiation by both installation location and finned radiant energy rejection container.
   4. Temperature sensors used in BTU calculations shall be a matched pair with a differential accuracy of ±0.15 degrees F over entire range and supplied by the BTU system manufacturer.
   5. RTD Sensor

Accuracy (Room Sensor Only)	minimum ±0.5 degrees F
Accuracy (Averaging)	minimum ±0.6 degrees F
Range	minimum 30 to 100 degrees F

   6. Thermistor

Accuracy (All)	minimum ±0.36 degrees F
Range	minimum 0 to 150 degrees F
Heat Dissipation Constant	minimum 2.7 mW/°C

   7. Temperature Transmitter

Accuracy	minimum ±0.1degrees F or ±0.2% of span
Output	4-20mA

   8. Use averaging elements on duct sensors when the ductwork is ten square feet or larger.

9. All mixed air and heating coil discharge sensors shall have averaging elements regardless of duct size.
10. In piping systems use temperature sensors with separable wells designed to be used with temperature element.

D. Humidity Sensor
1. General
   a. Capacitive thin-film polymer sensor types with a range of 0-100%RH
   b. Accuracy: +/-2%
   c. Stability: less than 0.5% drift per year
   d. Temperature effect: less than 0.005% per degree F.
2. Outdoor
   a. Use sensor designed for outside air use along with weather enclosure.

E. Pressure Sensor/Transducer (for air system)
1. Manufacturers
   a. Duct Mounted Applications (VAV): Vaisala, Kele, Honeywell or equal.
   b. Outdoor Static Pressure Monitoring: Vaisala model SPH10 with PTB210 pressure transducer or equal for outside air reference.
2. Provide transmitter that operates on the capacitance principle and is capable of sensing low positive, negative, or differential pressures.
3. Transmitter shall have minimum of three pressure ranges adjustable by an on-board switch or jumper. Size the transmitter where the middle or high range is suitable for the application. (do not need adjustable range for VAV box application)
4. Use a bi-directional transmitter for applications that may have both positive and negative pressure excursions.
5. Transmitter shall be provided with an integral four-digit display of the pressure sensed (do not need display for VAV box application)
6. Performance Requirement
   a. Duct Mounted Applications (VAV Control)

Accuracy	+/-1% full scale
Compensated Temperature Range	32 to 140˚degrees F
Temperature Effect	0 – 1 inches w.g. range 0.9% full scale/°F >1 inches w.g. range 0.01% full scale/°F
Stability	0 – 1 inches W.G. range: 2.0% max. drift per year 0 – 10 inches W.G. range: 0.5% max. drift per year
Output	4-20mA
Load Impedance	800 ohm minimum
Operating Temperature	32°F to 140°F degrees F

F. Differential Pressure Switch (for Air Systems)
1. Manufacturers
   a. Cleveland Controls
   b. Or equal.
2. Low Pressure Applications (less than 2 inch W.C. (500 Pa))
   a. Performance

Setpoint Pressure Range	0.05 to 2.0 inch W.C
Compensated Temperature Range	-40 to 140 degrees F
Operating Temperature	-40 to 140 degrees F

b. Typical Applications
   1) Filter Differential Pressure Switch

3. Standard Pressure Applications (0.4 to 12 inch W.C.)
   a. Performance

Setpoint Pressure Range	0.4 to 12.0 inch W.C. (100 to 3 000 Pa)
Compensated Temperature Range	-40 to 140 degrees F (-40 to 60 degrees C)
Operating Temperature	-40 to 140 degrees F (-40 to 60 degrees C)

   b. Typical Applications:
      1) High Static Discharge Alarm
      2) Low Static Alarm
      3) Fan Differential Pressure

G. Current Sensor
   1. Provide a current sensor with adjustable threshold and digital output with LED display, Veris H-708/H904 or equal.
   2. Threshold adjustment must be by a multi-turn potentiometer or set by multiprocessor that will automatically compensate for frequency and amperage changes associated with variable frequency drives.
   3. When used on variable speed motor application, use a current sensor that will not change state due to varying speeds.

H. Carbon Dioxide (CO2) Sensor
   1. Carbon Dioxide sensor shall utilize non-dispersive infrared (NDIR) technology.
   2. The sensor shall have an automatic calibration algorithm that will compensate for sensor drift over time due to sensor element degradation.
   3. Device shall be provided with a 0-10VDC or 4-20mA analog output that is selectable and a field adjustable relay alarm output.
   4. The sensor shall be user calibrated with a minimum calibration interval of five years.
   5. Performance

Range	0 – 2000 ppm CO2
Accuracy	+/-2% full scale (±30ppm)
Response Time	< 1 min.
Compensated Temperature Range	32 to 250 degrees F
Temperature Effect	0.03% full scale / °F
Stability	0.5% max. drift per year
Output	4-20mA
Load Impedance	600 ohm minimum
Operating Temperature	55 to 113 degrees F

   6. Wall Mounted
      a. Provide with built in CO2 level display

2.2 THERMOSTATS

A. Thermostat shall have numeric temperature setpoint in degrees range from 55 to 85 degrees F with accuracy of ± 0.5 degrees F.

B. Thermostat shall have setback capability to program up to four time and temperature settings per schedule.

C. Thermostat shall have capability of automatic change over for heating and cooling.

D. Furnish fan override switch with three speed fan controls.

E. Space Thermostats
   1. All room thermostat in non-public spaces shall have exposed setpoint adjustment with internal stops or software stops for minimum and maximum setting initially set between 68 to 76 degrees F.
   2. All room thermostats in public areas will have concealed setpoint adjustment with blank cover. Setpoint stops shall be accessible only to authorized personnel, to restrict over-heating or over-cooling.

2.3 ELECTRONIC VALVE ACTUATOR

A. Manufacturers
   1. Danfoss.
   2. Or equal.

B. Provide all control valves as shown on the drawings and as required to perform function specified in sequence of operation.

C. Direct mounted, self-calibrating type designed for a minimum 60,000 full stroke cycles at rated force and shall be from the same manufacturer as the pressure independent control valve.

D. Size for torque required for valve close off at 150 percent of total system (head) pressure for two-way valves; and 100 percent of pressure differential across the valve or 100 percent of total system (pump) head differential pressure for three-way valves.

E. Actuator shall allow smooth and position operation of devices served and to provide sufficient torque capacity for tight shutoff against system temperature and pressure encountered.

F. Full proportional actuator use 0-10VDC inputs and zero and span adjustment.

G. For two position actuator use 24VAC, 120VAC actuator may be used for hardwire interlock.

H. Actuator for applications other than terminal units shall be provided with a manual override capability.

I. Actuator shall be provided with a visible position indicator and shall possess a 2-10V DC position feedback signal allowing the EMCS to read the exact position of the valve and provide information for EMCS algorithm to calculate the exact flow rate through the valve with accuracy +/- 5%.

J. Actuator shall have automatic reset button compatible with the valve to automatically recalibrate the 0-10 V input/output signal to match the maximum high limit flow set on the valve.

K. Provide spring-return for application involving moisture protection or specified normally open/close operation.

L. Valves shall move to their fail positions on loss of power to the actuator.

M. Provide actuators with linkages and brackets for mounting on device served.

N. Coupling: Directly couple end mount to stem, shaft, or ISO-style direct-coupled mounting pad.

O. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to deactivate the actuator at the end of rotation.

P. Fail-Safe Operation: Electronic fail safe shall incorporate a visual indication of the fail safe status on the face of the actuator. The power fail position shall be field adjustable between 0 to 100% in 10o increments. The electronic fail safe shall have a 2 second operational delay.

Q. Temperature Rating: -22 to 122 degrees F.

R. Housing: Minimum requirement NEMA type 2 / IP54 mounted in any orientation.

S. Agency Listing: ISO 9001, cULus, and CSA C22.2 No. 24-93.

2.4 ELECTRONIC DAMPER ACTUATOR

A. Manufacturers
   1. Belimo.
   2. Honeywell.
   3. Or equal.

B. Size operators for smooth and positive operation of devices serve, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered.

C. Damper actuator shall be located outside of air stream unless otherwise indicated such as on fire damper. In no case shall damper actuator for fume exhaust system be located in the air stream or require entering the air stream to service an actuator.

D. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.

E. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.

F. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to prevent any damage to the actuator during a stall condition.

G. Fail-Safe Operation: Mechanical, spring-return mechanism. Electronic fail safe shall incorporate a visual indication of the fail safe status on the face of the actuator. The power fail position shall be field adjustable between 0 to 100% in 10 degree increments. The electronic fail safe shall have a 2 sec operational delay.

H. Power Requirements (Spring Return): 120 V-ac, maximum 10 VA at 24-V ac or 8 W at 24-V dc.

I. Full proportional actuator use 0-10VDC inputs and zero and span adjustment.

J. Proportional Actuators shall be fully programmable. Control input, position feedback and running time shall be factory or field programmable by use of external computer software Diagnostic feedback shall provide indications of hunting or oscillation, mechanical overload and mechanical travel. Programming shall be through an EEPROM without the use of actuator mounted switches.

K. For two position actuator use 24 VAC, 120 VAC actuator may be used for hardwire interlock.

L. Temperature Rating: -22 to 122 degrees F.

M. Housing: Minimum requirement NEMA type 2 (4/4X) / IP54 (IP67) mounted in any orientation.

N. Actuator stroke time shall match the requirements of the DDC controller for proper operation.

O. All electric actuator will be provided with overload protection to prevent motor from damage when stall application involving fire, moisture protection or specified normally open/close operation.

P. Provide damper end switch with dry contact where control sequences require damper position indication. End switches shall not contain mercury.

Q. Provide operators with linkages and brackets for mounting on device served.

R. Agency Listing: ISO 9001, cULus, and CSA C22.2 No. 24-93.

S. Actuator to have manual override capability.

2.5 CONTROL VALVES

A. Manufacturer
   1. Danfoss AB-QM.
   2. Or equal.

B. Pressure independent globe type valve.

C. Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

D. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional (except as noted).

E. Pressure Independent Temperature Control Valves

1. Factory fabricated pressure independent with internal differential pressure regulator consisting of EPDM diaphragm, stainless steel spring and pressure control disc which automatically adjusts to normal changes in system pressure providing 100 percent control valve authority at all positions of the valve. Valve shall be globe type to maintain a linear flow characteristic, accurately controlling flow from 0-100 percent full rated flow with an operating pressure differential range of 3 to 60 psi. Valve leakage shall meet FCI 70-2 Class IV leakage rating (0.01 percent of valve Kv). Unless otherwise specified or shown, valves shall be two way pressure independent globe-style bodies. Hydronic system pressure independent control valve bodies shall meet ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150 percent of the system design operating pressure.
2. NPS 2 and smaller: Class 150 bronze or brass body with union connections, stainless steel trim, stainless steel rising stem, stainless steel disc, and screwed ends with backseating capacity repackable under pressure.
3. NPS 2-1/2 and larger: brass or bronze body, stainless steel trim, stainless steel rising stem, stainless steel disc, flanged ends with backseating capacity repackable under pressure
4. Sizing
   a. Valve manufacturer shall provide ½" to 10" valves. Valves shall be from single manufacturer.
   b. Two position: shall be based of flow and line sized.
5. Close-Off Pressure Rating: 125 psi for valves under NPS 1 1/4 and smaller and 250 psi for NPS 1 1/2 and larger.
6. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory with a single screw on a four-way DIN mounting-base.
7. Valves NPS 1 1/4 and smaller for individual coil control shall be provided as part of a pipe package including the following. All components shall be factory assembled.
   a. The supply side of the coil shall contain a strainer/shut-off ball valve/drain, manual air vent with a P/T port.
   b. The return side of the coil shall contain a union fitting with a P/T port, characterized control valve, an integrated manual balancing valve/union/isolation ball valve/manual air vent with P/T port.
   c. Shut-off valves as an integrated part of the characterized control valve are prohibited.
   d. For 3-way installations, supply an integrated 100 percent port isolation valve/manual air vent with a P/T port for field installation in the bypass of the circuit.
   e. A 24 inches stainless steel flexible hose set shall be provided for each coil supply and return connection for all pipe packages.
8. Valve must maintain flow accuracy under 5% from 0-100% full rated flow with an operating pressure differential ranging from 5-60 psig for valve sizes NPS ½ to NPS 1-1/4, 4-60 psi for size NPS 1-1/2 to NPS 10, and 2.3 to 60 psi for NPS ½ low flow valve.

F. Control valve to have manual override capability.

2.6 GENERAL AIRFLOW MEASURING STATIONS

A. Airflow station shall be thermal dispersion type by Ebtron or equal for the following application

1. Duct and plenum mounted airflow and temperature measurement device
2. Fan inlet mounted airflow measurement devices

B. Pitot tubes and arrays are not acceptable.

C. Vortex shedding devices are not acceptable.

D. Provide airflow measuring station where indicated on the plans.

E. Furnish installation and maintenance instruction from manufacturer and install the airflow station accordingly.

F. Submit product data sheets for airflow measuring devices indicating minimum placement requirements, sensor density, sensor distribution, and installed accuracy to the host control system.
   1. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes shall demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.

G. Submit airflow measuring station schedule detailing the airflow range to be measured, corresponding velocity pressure, differential pressure transducer range, and airflow station size.

H. Provide access door to airflow station for maintenance.

I. Each airflow measuring station shall consist of one or more sensor probes and a single, remotely mounted, microprocessor based transmitter capable of independently processing up to 16 independently wired sensor nodes contained in one or more probe assemblies per measurement location.

J. The maximum allowable pressure loss through the station shall not exceed 0.085-inch w.c. at 1000 fpm, or 0.15-inch w.c. at 2000 fpm. Each station shall be capable of measuring the airflow rate within an accuracy of 2 percent as determined by U.S.G.S.A. certification tests. The station(s) shall have a self-generated sound rating of less than NC 40, and the sound level within the duct shall not be amplified.

K. All Sensor Probes
   1. Each sensor node, consisting of two thermistor-sensors and their structural housing, shall independently determine the airflow rate and temperature at each measurement point.
   2. Each sensor node shall be factory calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST). Thermistor sensor calibrations traceable only to temperature standards are not acceptable.
   3. Airflow Accuracy: +/- 2% of reading over entire operating airflow range
   4. Temperature Accuracy: ±0.25 degrees F over the entire operating temperature range of -20 to 160 degrees F.
   5. Relative Humidity: 0 to 99% (non-condensing) operating humidity range for each sensor probe. Product design shall consider direct exposure to or emersion in liquid water and temporary exposure shall not damage the sensing element.
   6. Single source responsibility for airflow temperature measuring probes and transmitter for each airflow measurement station.

L. Duct and Plenum Probes
   1. Probes shall be constructed of extruded, gold anodized 6063 aluminum tube or type 316 stainless steel tubes. Al internal wires within the tube shall be Kynar coated. PVC insulated conductors are not acceptable.
   2. Probe Sensor Density shall be as below:

AREA (SQ. FT)	SENSORS
≤1.5	**2**
>1.5 AND <4	**4**
4 AND < 8	**6**
8 AND < 12	**8**
12 AND < 16	**12**
≥16	**15**

3. Sensor probe design shall be capable of providing up to 8 sensor nodes per probe.
4. The minimum operating airflow range shall be 5,000 FPM (0 to 25.4 m/s) unless otherwise indicated on the plans
5. Each ducted sensor probe shall have an integrated UL listed, plenum rated cable. Cable jackets and conductor insulation shall be FEP, Teflon-FEP or Neoflow-FEP. Cables shall include a terminal plug for connection to the remote mounted transmitter. All terminal plug interconnecting pins shall be gold pated. PVC jacketed cables or PVC insulated conductors are not acceptable with ducted sensor probes.

M. Fan Inlet Probe

1. Sensor node assemblies shall be mounted on Type 304 stainless steel housing.
2. Mounting rods shall be filed adjustable to fit the fan inlet and constructed of zinc plated steel.
3. Identify mounting style as “face mount” or “throat mount”.
4. Face mount style shall provide no mechanical fastening in the throat or on the surface of the inlet cone and shall be used on all inlet condition sensitive plenum type or plug fans.
5. Mounting feet shall be constructed of Type 304 stainless steel.
6. The minimum operation airflow range shall be 10,000 FPM unless otherwise indicated on the plan.
7. Fan inlet probe cables shall be UL plenum rated and may be FEP or PVC jacketed.

N. Transmitter

1. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. The LCD display shall be capable of displaying individual airflow and temperature readings of each independent sensor node.
2. The transmitter shall be capable of filed configuration and diagnostics using an on-board pushbutton interface and LCD display.
3. The transmitter shall have an on-off power switch and operate on 24 VAC. Isolation transformers shall not be required.
4. The transmitter shall use a switching power supply, fused and protected from transients and power surges.
5. The transmitter shall use “watch-dog” circuitry to assure automatic reset after power disruption, transients and brown outs.
6. All interconnecting pins, headers and connection so n the main circuit board, cards and cable receptacles shall be gold plated.
7. The operating temperature range for the transmitter shall be -20 to 120 degrees F. The transmitter shall be installed at a location that is protected from weather and water.
8. The transmitter shall be capable of communicating with other devices using one of the following interface options:
   a. Linear analog output signals for airflow and temperature. Filed selectable, fuse protected and electrically isolated from all other circuitry, 0-5VDC/0-10VDC/4-20mA (4-wire)
   b. Field Selectable LonTalk, BACNet-MS/TP, BACNet-ARCNET: Provide dynamic link libraries and VBA functions to interface Ethernet devices to Microsoft Excel for remote monitoring of airflow and temperature using a MS Windows based PC.

9. The transmitter shall be capable of providing an infra-red interface for manually downloading transmitter configuration data using a handheld PDA
10. Provide PDA upload/download software for multiple users.
    a. Download software shall be capable of displaying and saving individual sensor airflow rates, the average airflow rate, individual sensor temperatures and the average temperature received from the transmitter
    b. Upload software shall be capable of displaying and saving all setup parameters that can be configured using the on-board pushbutton interface and LCD display.
11. Provide a Microsoft Excel file capable of creating test and balances reports from PDA dat files transferred to a Window based PC.
12. Provide a Microsoft Excel file to create configuration data files that can be transferred from a Window based PC to a PDA for upload to one or more transmitters.
13. Provide transmitter that will average up to sixteen sensors and provide two filed selectable linear analog output signals (4-20 mA and 0-10 VDC) proportional to airflow and temperature. Sensor electronic circuitry other than the temperature sensors shall not be exposed to the air stream and shall be protected from moisture to prevent failure.

2.7 ELECTRONIC AIRFLOW TRANSMTTERS

A. The transmitter shall be capable of receiving flow signals (total and static pressure) from an airflow station or probe array and produce dual outputs linear and scaled for air volume, velocity, differential pressure, etc.

B. The transmitter shall contain an integral multi-line digital display for use during the configuration and calibration process, and to display one transmitter output during normal operating mode. All transmitter configuration, parameter setting, zero and span calibration, plus display formatting and scaling will be performed digitally in the on-board microprocessor via input push-buttons.

C. The transmitter will be available in multiple natural spans covering the range of 0.05 to 10.0 inches W.C. with an accuracy of plus or minus 0.25 percent of natural span. The transmitter shall be furnished with a transducer automatic zeroing circuit and be capable of maintaining linear output signals on applications requiring 10 to 1 velocity (100 to 1 pressure) turndown.

D. The transmitter shall be the VELTRON II as manufactured by Air Monitor Corporation or equal.

E. Provide Digital Output for connection to Building Control System for flow totalization.

2.8 TERMINAL UNIT ACTUATORS

A. Manufacturers:
    1. Belimo
    2. Or equal.

B. Close-Off (Differential) Pressure Rating: 200 psi.

C. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle or an ISO-style direct-coupled mounting pad.

D. Power Requirements: 24V-ac/dc.

E. Temperature Rating: -22 to 122 degrees F.

F. Housing Rating: Minimum UL94-5V(B) flammability.

G. Agency Listing: CE, UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC.

PART 3 EXECUTION

3.1 INSTALLATION

A. All wiring shall be in conduit. Conduit shall be run parallel or perpendicular to walls and building lines.

B. Wires shall be labeled with a plastic permanent label with minimum 1/8” sized letters (hand written label not acceptable) at junction point to each apparatus point of connection.

C. Wiring shall not use the voice/data wire way/ conduit systems as pathways.

D. Check and verify location of thermostats and other exposed control sensors with plans and room details before installation.

E. Locate room thermostats and sensors align with light switches and carbon dioxide sensor. Standard mounting height will be 48 inches, required height for ADA compliance.

F. For drywall installation, room sensor mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

G. Any room thermostats or sensors mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Sub-base to provide a minimum of one half inch of insulation.

3.2 LABELS AND TAGS

A. Provide labels for all field devices including sensors, meters, transmitter and relays. Labels shall be plastic laminate with letter not less than 1/2-inch and located adjacent to the device.

B. Junction box covers shall be painted yellow and labeled “EMCS”.

3.3 TESTING

A. When installation is complete, the Contractor shall perform the following:
   1. A 100 percent filed calibration of all sensors and equipment. Calibration of sensors and control devices shall in compliance with Title 24 requirements.
   2. Verify of each control point by comparing the control demand and the field devices.

END OF SECTION

SECTION 230960
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Variable Volume Air Handling Unit (AHU-1, AHU-2)

B. Variable Volume Air Handling Unit (AHU-3)

C. Constant Volume Package Unit (PAC-1)

D. Lab Exhaust Fans (EF-1, EF-2, EF-3, EF-4)

E. Non-Hood Rooms

F. VAV Hood Rooms

G. Chilled Water System

H. Heating Hot Water System

I. Zones Control

J. Fan Systems

K. Miscellaneous Systems

1.2 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which the controls function. Requirements for each type of control system operation are specified. Equipment, devices and system components required for control systems are specified in other Sections.

1.3 RELATED SECTIONS

A. Section 019113 – COMMISSIONING REQUIREMENTS.

B. Section 015719 – CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT.

1.4 SUBMITTALS

A. Submit diagrams indicating the mechanical system controlled and all control system components. Label with settings, adjustable range of control and limits. Include written description of control sequence referencing all labeled devices and equipment.

B. Include flow diagrams for each control system, graphically depicting control logic.

C. Meet with the Owner's operations personnel or appointed representative to formulate the graphic representation of the control systems and displayed information. As a minimum, the mechanical system components, control system components, and controlled function status and values shall be displayed.

1.5 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 016000.

B. Accurately record actual setpoints and settings of controls, including changes to sequences made after submission of shop drawings. Record drawings shall indicate all control device locations.

1.6 SYSTEM STARTUP

A. After a power outage, the control system shall reset to the last operating condition and re-energize equipment based upon the following schedule. Each piece of equipment shall be energized with a 1 minute (adj.) delay between equipment starts:
   1. Air Handling Unit
   2. Exhaust and Supply Fans

1.7 LEED

A. This project is required to achieve certification under LEED-NC v 2009. Please review the LEED Requirements Section 01 8113 of this Specifications Manual.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 VARIABLE VOLUME AIR HANDLING UNIT (AHU-1, AHU-2)

A. General: Air handling unit shall consist of supply and return fans, final filter, cooling and heating coils and economizer mixing box.

B. Air handling unit shall be on emergency power.

C. Indoor Design Temperature Criteria: 76 degree F (summer) and 68 degree F (winter).

D. Operational Schedule
   1. Unit will run 24/7 and energized through the energy management control system (EMCS) in the automatic mode. AHU operation divided into occupied and unoccupied modes. AHU shall run during unoccupied mode to supply make-up air for laboratories which are continuously exhausted.

a.	Weekday :	7:00 a.m. to 5:59 p.m.	Occupied
		6:00 p.m. to 6:59 a.m.	Unoccupied
b.	Saturday:	7:00 a.m. to 5:59 p.m.	Occupied
		6:00 p.m. to 6:59 a.m.	Unoccupied
c.	Sunday:	12:00 a.m. to 11:59 a.m.	Unoccupied
d.	Holiday:	12:00 a.m. to 11:59 a.m.	Unoccupied

   2. Provide capability for a time based override of 1 hour (adj.). The override time shall be variable between 1 and 4 hours. Upon receiving an override signal from a variable air volume thermostat, the air handling unit shall operate in override mode for the scheduled override time (1 hour, adj.).
   3. During occupied mode, the space temperature will be maintained per setpoint. An individual laboratory space may become unoccupied during lunch time or any other event. When the space becomes unoccupied, the space occupancy sensors (from lighting system) will inform the EMCS that the space is unoccupied and the space air circulation will be reduced to 4 air changes as long as the space is unoccupied. Temperature setpoint is maintained. **ADD-3**
   4. After-hours Operation past Occupied hours
      a. The air handling unit associated with the after-hours zone shall resume occupied mode setpoints to provide air conditioning to meet cooling/heating demand setpoint (setpoint at minimum 6 air changes per hour).
      b. Exhaust fans associated with the energized air handling unit shall remain on.
      c. The unit shall continue to operate in after-hours mode for 1 hour (adj.) OR when the occupancy sensor detects no occupants in the space for more than 30 minutes, the zone shall go back into unoccupied hours set back controls.
   5. Unoccupied Hours Operation
      a. The air handling unit shall run and continuously supply laboratory spaces at 4 air changes per hour and other VAV boxes set to minimum airflows.
      b. Exhaust fans associated with the air handling unit shall remain on.

c. The outside air minimum damper shall remain open. Outside air modulating damper shall be closed.
d. Cooling required during unoccupied mode:
   1) The supply air discharge temperature shall be set to 65°F (adj.)
   2) The economizer cycle shall be utilized when conditions permit as outlined in the economizer sequence of operations, otherwise the outside air dampers shall remain closed.
e. Heating required during unoccupied mode:
   1) The supply air discharge temperature shall be set to 85°F (adj.)
   2) The outside air dampers shall remain closed.

E. Variable Frequency Drive Operating Modes
1. Hand Position: Fan shall run bypassing all control interlocks, all safety interlocks shall be satisfied (high static, fire alarm).
2. Off Position: Fans shall not run.
3. Auto Position: Fans shall run provided all safety provisions are satisfied.

F. Monitor
1. Supply Fan Status: The VFD shall report supply fan status via network card and current sensing relay to the EMCS.
2. Supply Fan Speed: The VFD shall report the supply fan speed to the EMCS.
3. Outside Airflow: The outside airflow measuring station shall report the outside airflow to the EMCS.
4. Supply Fan Airflow: The supply air airflow measuring station shall report the supply airflow to the EMCS.
5. Return Fan Status: The VFD shall report return fan status via network card and current sensing relay to the EMCS.
6. Return Fan Speed: The VFD shall report the return fan speed to the EMCS.
7. Return Fan Airflow: The return air airflow measuring station shall report the supply airflow to the EMCS.
8. Return Air Temperature: The return air temperature sensor shall report the return air temperature to the EMCS.
9. Mixed Air Temperature: The mixed air temperature sensor shall report the mixed air temperature to the EMCS.
10. Filter Status: The differential pressure sensor shall report the filter pressure drop to the EMCS.
11. All Valve Positions: Valve positions shall be reported via the control valve commanded position to the EMCS.
12. All Damper Positions: Damper positions shall be reported via the damper actuator commanded position to the EMCS.
~~12.~~13. Room Occupancy: Lighting system shall report room occupancy to the EMCS. **ADD-3**

G. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Supply Air Fan VFD Status OR VFD Alarm	Supply Air Fan Failure	Shut down supply air fan
One	Return Air Fan VFD Status OR VFD Alarm	Return Air Fan Failure	Shut down return fan
One	Supply Air discharge static pressure exceeds 3.5 inches W.C. (adj.)	Supply Air Fan High Static	Shut down AHU
One	Return Air discharge static pressure exceeds 2.5 inches W.C. (adj.)	Return Air Fan High Static	Shut down AHU
Two	High zone temperature	High Zone Temperature	None – notification only.
Two	Low zone temperature	Low Zone Temperature	None – notification only.
Two	High zone static pressure	High Zone Static Pressure	None – notification only.
Two	Low zone static pressure	Low Zone Static Pressure	None – notification only.
Two	Any valve command does not match status (alarm shall specify failed valve)	Valve Failure (showing name of alarmed valve)	None – notification only.
Two	Filter bank pressure differential exceeds 1-inch W.C.	Filter High Static	None – notification only.
Two	Any damper actuation failure (alarm shall specify failed damper)	Damper Failure (showing name of alarmed damper	None – notification only
Two	Outside airflow falls 10 percent below minimum for 5 minutes (adj.)	Low Ventilation Air	None – notification only

H. Fire Alarm Control

1. Activation of the duct detector in the fan discharge ductwork shall trigger a fire alarm. Fire alarm shall shutdown supply and return fans and close outside air dampers after 120 seconds when the alarm is activated to allow occupants to get out of the laboratory spaces which are kept at negative pressure. The wiring and conduit from the duct detector for fan shut down shall be provided.
   a. Supply Fan: OFF as controlled by fire alarm.
   b. Return Fan: OFF as controlled by fire alarm.
   c. Outside Air (Minimum) Damper Position: CLOSED as controlled by fire alarm.
   d. Outside Air (Modulating) Damper Position: CLOSED as controlled by fire alarm.
   e. Return Air Damper Position: CLOSED as controlled by fire alarm.
   f. Exhaust Air Damper Position: OPEN as controlled by fire alarm.

I. Supply Air Temperature Control

1. The discharge air temperature shall signal the EMCS to modulate water flow to maintain discharge air temperature setpoint of 55°F (adj.)
2. The supply air temperature shall be reset from 55°F to 60°F (adj.) based on supply air temperature reset.
3. Supply air temperature reset
   a. During occupied mode, the supply air set point shall be reset from 55°F when outdoor temperature is 70°F (adj.) and above, proportionally up to 60°F (T-max) when outdoor air is 60°F and below.
   b. T-max shall be reset using trim and respond logic.
      1) While fan is proven on, increase setpoint by 0.2°F, every 5 minutes, if there are 3 (adj) or fewer zone cooling requests.

2) If there are 3 (adj.) or more cooling requests decrease the setpoint by 0.2°F. A cooling request is generated when the cooling loop of any zone served by the system is greater than 99%.

c. Restrooms, corridors and storage space zones should be excluded from any reset schedule reference tables.

J. Supply Fan Static

1. Supply fan speed will modulate to maintain duct static pressure as described below
   a. The static pressure setpoint will be reset based on the highest zone pressure demand. The low/high static reset setpoints will be established by the test and balance contractor. The system will be programmed at startup with the following adjustable numbers;

Low Static Setpoint (LS-SP)	0.5 in WG
High Static Setpoint (HS-SP)	1.5 in WG

   b. Upon confirmed fan status, the supply fan VFD will be ramped up to meet the HS-SP. Once the setpoint is reached the VFD will be modulated to the meet the reset static pressure setpoint (RSP-SP).
   c. Duct Pressure Reset Schedule
      1) Static pressure setpoint shall be reset using trim and respond logic within the range shown above (to be confirmed by TAB contractor). When fan is off, setpoint shall be at minimum value.
      2) When fan is proven on, decrease set point by 0.05" WC every 2 minutes, if there are 2 (adj.) or fewer pressure requests. If there are more than 2 (adj.) pressure requests, increase the set point by 0.05" WC.
      3) The EMCS shall poll the position of each VAV terminal unit damper every 3 minutes (adj.).
      4) The position of each damper shall be reported by the VAV controller.
      5) Pressure request is generated when any VAV terminal unit served by the system is 85% open.
   d. Restrooms, corridors and storage space zones should be excluded from any reset schedule reference tables.
2. If at any time the duct static pressure measured at the high limit safety trip in the unit exceeds the duct static HS-SP, the inline mechanical high static safety switch will open and shut down all the associated fans. A high static alarm will be generated by way of an auxiliary set of contacts on the safety switch. The unit must be manually reset at the switch. The switch will be mounted in the control panel on exterior locations and adjacent to the control panel in indoor locations and where the control panel is mounted inside an access door on the AHU.

K. Outside Ventilation Air Control

1. Economizer Control
   a. Monitoring
      1) Reference outside air dry bulb temperature in °F.
      2) Common return air dry bulb temperature in °F.
   b. Operation
      1) The controller shall modulate the outside air modulating, relief and return dampers in sequence to maintain the mixed air temperature setpoint 2°F (adj.) less than the discharge air temperature setpoint.
         (a) The economizer shall be enabled whenever:
            (i) Outside air temperature is less than 74°F (adj.).
            (ii) AND outside air dry bulb temperature is less than the common return air dry bulb temperature.
            (iii) AND the supply fan status is on.
            (iv) AND outside air relative humidity is less than 80% (adj.).
      2) When the unit is started in occupied mode and outside air temperature is less than 40°F (adj.), the modulating outside air damper shall ramp open to its minimum set point over a 5 minute (adj.) period and the economizer PID calculation shall be disabled. Only after this period shall the economizer PID output start calculating. When OAT is >40°F, there shall not be a delayed ramp open period.

3) When economizer is enabled, the following operations shall be allowed to occur as needed and in the order listed to achieve mixed air temperature setpoint:
   (a) First, outside air minimum damper shall fully open.
   (b) Then, the outside air modulating damper shall modulate from closed to full open.
   (c) Then, the return air damper shall modulate to fully closed. Economizer PID output shall continue to reset return damper from its controlled modulated position to achieve minimum OA and plenum pressures to fully closed, 0% open.
   (d) Relief damper shall fully open.
4) The outside air modulating damper shall close and the return air damper shall open when:
   (a) Mixed air temperature drops from 50°F (adj.) to 45°F (adj.).
   (b) OR loss of supply fan on status.
   (c) OR if unit is commanded off.

2. Demand Control Ventilation
   a. Monitoring
      1) Zone carbon dioxide levels in parts per million. Does not apply to all zones refer to plans for specific locations.
      2) Outside ventilation airflow rate. (in cubic feet per minute).
      3) Maximum allowable CO_2 levels: equal to outside air CO_2 concentration plus 600 ppm. This level shall be measured at 5 min. (adj.) intervals.
   b. Operation
      1) When not in economizer mode, unit shall operate at the demand control ventilation (DCV) minimum setpoint as indicated in the schedules with outside air minimum damper in open position.
      2) If any zone air carbon dioxide levels reach the maximum allowable CO_2 levels, the modulating outside air damper shall begin to open.
      3) The outside air modulating damper shall modulate from the DCV minimum setpoint to the maximum design outside air ventilation rate. The damper shall increase the outside air flow rate 10 percent (adj.) of the differential between maximum design outside air ventilation rate and DCV minimum setpoint every 1 minute (adj.).
      4) If CO_2 level continues to be above maximum level the damper shall continue to open up to the maximum design outside air flowrate.
      5) Once all zones are less than the maximum allowable CO_2 level the modulating outside air damper shall not open further. The damper shall remain at this flow rate until the CO_2 concentration in all zones drops below OSA concentration plus 500 ppm (adj.).
      6) Once the CO_2 concentration for all zones drops to outside air CO_2 concentration plus 400 ppm (adj.), the modulating outside air damper shall close.

L. Return Fan Control
   1. The return fan speed shall be modulated to maintain an average zone pressurization of 0.01" w.c. (adj.) greater than the exterior reference pressure.
   2. Variable speed drive shall be provided with a direct connection to the EMCS for monitoring and commanding the variable speed drive points from the EMCS workstation.

M. Morning Flush Control
   1. Monitoring
      a. Return air temperature
   2. Operation
      a. Prior to scheduled occupancy the air handling unit shall operate in 1 hour (adj.) flush mode followed by a warm up mode. In the flush mode the unit shall supply the minimum design outside ventilation air.
      b. The supply air temperature setpoint shall be set to 55°F (adj.).

N. Morning Warm-Up
   1. Morning warm-up shall run when the lowest indoor air temperature is less than 65°F (adj.).
   2. The system shall be set to with the outside air modulating damper closed and outside air minimum damper open. The chilled water valve shall be closed.
   3. SAV/VAV boxes and reheat coil control valves shall remain fully open until the space temperature setpoint of 68°F (adj.) is achieved and then will modulate to maintain the space temperature setpoint.

4. System shall operate in this mode until internal temperatures setpoints are met at which point VAV boxes and air handling unit shall revert to normal operation.

O. Valve Failure Configuration
1. Actuation for the modulating outside air dampers shall be fail closed.
2. Actuation for minimum outside air damper shall be fail open.
3. Actuation for return air damper shall be fail open.
4. Actuation for the chilled water control valve shall be fail open.
5. Actuation for the heating hot water control valve shall be fail open.
6. Actuation of the exhaust air damper shall be fail open.

P. Minimum Requirements for Operator Workstation Display
1. Supply fan VFD status
2. Supply fan VFD fault
3. Supply fan VFD by-pass
4. Supply fan on-off status
5. Supply fan speed
6. Supply fan static pressure setpoint
7. Supply fan static pressure (actual)
8. Supply fan high static pressure
9. Supply air airflow
10. Supply air temperature
11. Supply air temperature setpoint
12. Supply air downstream static pressure
13. Smoke Detector status
14. Return fan VFD status
15. Return fan VFD fault
16. Return fan VFD by-pass
17. Return fan on-off status
18. Return fan speed
19. Return fan high static pressure
20. Return air airflow
21. Return air temperature
22. Return air modulating damper position
23. Outside air airflow
24. Outside air modulating damper position
25. Outside air minimum damper position
26. Outside air temperature
27. Outside air relative humidity
28. Exhaust air modulating damper position
29. Chilled water return valve command
30. Heating hot water return valve command
31. Final filter status
32. Mixed air temperature
~~32.~~33. Room Occupancy **ADD-3**

3.2 VARIABLE VOLUME AIR HANDLING UNIT (AHU-3)

A. General: Air handling unit shall consist of supply and return fans, final filter, cooling and heating coils and economizer mixing box.

B. Indoor Design Temperature Criteria: 76 degree F (summer) and 68 degree F (winter).

C. Operational Schedule
1. Unit shall be energized through the energy management control system (EMCS) in the automatic mode based on the following adjustable schedule:

a.	Weekday:	7:00 a.m. to 5:59 p.m.	Occupied
b.		6:00 p.m. to 6:59 a.m.	Unoccupied
c.	Saturday:	7:00 a.m. to 5:59 p.m.	Occupied
d.		6:00 p.m. to 6:59 a.m.	Unoccupied
e.	Sunday:	12:00 a.m. to 11:59 a.m.	Unoccupied

f. Holiday: 12:00 a.m. to 11:59 a.m. Unoccupied

2. Provide capability for a time based override of 3 hours (adj.). The override time shall be variable between 1 and 4 hours. Upon receiving an override signal from a variable air volume thermostat, the air handling unit shall operate in override mode for the scheduled override time (3 hours, adj.).
3. After-hours Operation past Occupied hours
   a. Upon receiving an override signal from a zone controller, the EMCS shall energize the air handling unit associated with the after-hours zone and modulate all zones to minimum flow positions.
   b. The unit shall operate as during normal hours, including ventilation rates and economizer modes.
   c. Exhaust fans associated with the energized air handling unit shall remain off.
   d. The unit shall continue to operate in after-hours mode for the preset time set at the zone level controllers.
4. Unoccupied Hours Operation
   a. Upon receiving a signal from a zone controller that heat or cooling is required to maintain the zone setback heating or cooling temperature, the EMCS shall energize the air handling unit and modulate all zones to minimum flow positions.
   b. Exhaust fans associated with the air handling unit shall remain off and the outside air dampers shall remain closed.
   c. Cooling required during unoccupied mode:
      1) The supply air discharge temperature shall be set to 65°F (adj.)
      2) The economizer cycle shall be utilized when conditions permit as outlined in the economizer sequence of operations, otherwise the outside air dampers shall remain closed.
   d. Heating required during unoccupied mode:
      1) The supply air discharge temperature shall be set to 85°F (adj.)
      2) The outside air dampers shall remain closed.

D. Variable Frequency Drive Operating Modes
   1. Hand Position: Fan shall run bypassing all control interlocks, all safety interlocks shall be satisfied (high static, fire alarm).
   2. Off Position: Fans shall not run.
   3. Auto Position: Fans shall run provided all safety provisions are satisfied.

E. Monitor
   1. Supply Fan Status: The VFD shall report supply fan status via network card and current sensing relay to the EMCS.
   2. Supply Fan Speed: The VFD shall report the supply fan speed to the EMCS.
   3. Outside Airflow: The outside airflow measuring station shall report the outside airflow to the EMCS.
   4. Supply Fan Airflow: The supply air airflow measuring station shall report the supply airflow to the EMCS.
   5. Return Fan Status: The VFD shall report return fan status via network card and current sensing relay to the EMCS.
   6. Return Fan Speed: The VFD shall report the return fan speed to the EMCS.
   7. Return Fan Airflow: The return air airflow measuring station shall report the supply airflow to the EMCS.
   8. Return Air Temperature: The return air temperature sensor shall report the return air temperature to the EMCS.
   9. Mixed Air Temperature: The mixed air temperature sensor shall report the mixed air temperature to the EMCS.
   10. Filter Status: The differential pressure sensor shall report the filter pressure drop to the EMCS.
   11. All Valve Positions: Valve positions shall be reported via the control valve commanded position to the EMCS.
   12. All Damper Positions: Damper positions shall be reported via the damper actuator commanded position to the EMCS.
   ~~12.~~13. Room Occupancy: Lighting system shall report room occupancy to the EMCS. **ADD-3**

F. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Supply Air Fan VFD Status OR VFD Alarm	Supply Air Fan Failure	Shut down supply air fan
One	Return Air Fan VFD Status OR VFD Alarm	Return Air Fan Failure	Shut down return fan
One	Supply Air discharge static pressure exceeds 3.5 inches W.C. (adj.)	Supply Air Fan High Static	Shut down AHU
One	Return Air discharge static pressure exceeds 2.5 inches W.C. (adj.)	Return Air Fan High Static	Shut down AHU
Two	High zone temperature	High Zone Temperature	None – notification only.
Two	Low zone temperature	Low Zone Temperature	None – notification only.
Two	High zone static pressure	High Zone Static Pressure	None – notification only.
Two	Low zone static pressure	Low Zone Static Pressure	None – notification only.
Two	Any valve command does not match status (alarm shall specify failed valve)	Valve Failure (showing name of alarmed valve)	None – notification only.
Two	Filter bank pressure differential exceeds 1-inch W.C.	Filter High Static	None – notification only.
Two	Any damper actuation failure (alarm shall specify failed damper)	Damper Failure (showing name of alarmed damper	None – notification only
Two	Outside airflow falls 10 percent below minimum for 5 minutes (adj.)	Low Ventilation Air	None – notification only

G. Fire Alarm Control

1. Activation of the duct detector in the fan discharge ductwork shall trigger a fire alarm. Fire alarm shall shutdown supply and return fans when the alarm is activated. The wiring and conduit from the duct detector for fan shut down shall be provided.
   a. Supply Fan: OFF as controlled by fire alarm.
   b. Return Fan: OFF as controlled by fire alarm.
   c. Outside Air (Minimum) Damper Position: CLOSED as controlled by fire alarm.
   d. Outside Air (Modulating) Damper Position: CLOSED as controlled by fire alarm.
   e. Return Air Damper Position: CLOSED as controlled by fire alarm.
   f. Exhaust Air Damper Position: OPEN as controlled by fire alarm.

H. Supply Air Temperature Control

1. The discharge air temperature shall signal the EMCS to modulate water flow to maintain discharge air temperature setpoint of 55°F (adj.)
2. The supply air temperature shall be reset from 55°F to 60°F (adj.) based on supply air temperature reset.
3. Supply air temperature reset
   a. During occupied mode, the supply air set point shall be reset from 55°F when outdoor temperature is 70°F (adj.) and above, proportionally up to 60°F (T-max) when outdoor air is 60°F and below.
   b. T-max shall be reset using trim and respond logic.
      1) While fan is proven on, increase setpoint by 0.2°F, every 5 minutes, if there are 3 (adj) or fewer zone cooling requests.
      2) If there are 3 (adj.) or more cooling requests decrease the setpoint by 0.2°F. A cooling request is generated when the cooling loop of any zone served by the system is greater than 99%.

c. Restrooms, corridors and storage space zones should be excluded from any reset schedule reference tables.

I. Supply Fan Static

1. Supply fan speed will modulate to maintain duct static pressure as described below
   a. The static pressure setpoint will be reset based on the highest zone pressure demand. The low/high static reset setpoints will be established by the test and balance contractor. The system will be programmed at startup with the following adjustable numbers;

Low Static Setpoint (LS-SP)	0.5 in WG
High Static Setpoint (HS-SP)	1.5 in WG

   b. Upon confirmed fan status, the supply fan VFD will be ramped up to meet the HS-SP. Once the setpoint is reached the VFD will be modulated to the meet the reset static pressure setpoint (RSP-SP).
   c. Duct Pressure Reset Schedule
      1) Static pressure setpoint shall be reset using trim and respond logic within the range shown above (to be confirmed by TAB contractor). When fan is off, setpoint shall be at minimum value.
      2) When fan is proven on, decrease set point by 0.05" WC every 2 minutes, if there are 2 (adj.) or fewer pressure requests. If there are more than 2 (adj.) pressure requests, increase the set point by 0.05" WC.
      3) The EMCS shall poll the position of each VAV terminal unit damper every 3 minutes (adj.).
      4) The position of each damper shall be reported by the VAV controller.
      5) Pressure request is generated when any VAV terminal unit served by the system is 85% open.
   d. Restrooms, corridors and storage space zones should be excluded from any reset schedule reference tables.
2. If at any time the duct static pressure measured at the high limit safety trip in the unit exceeds the duct static HS-SP, the inline mechanical high static safety switch will open and shut down all the associated fans. A high static alarm will be generated by way of an auxiliary set of contacts on the safety switch. The unit must be manually reset at the switch. The switch will be mounted in the control panel on exterior locations and adjacent to the control panel in indoor locations and where the control panel is mounted inside an access door on the AHU.

J. Outside Ventilation Air Control

1. Economizer Control
   a. Monitoring
      1) Reference outside air dry bulb temperature in °F.
      2) Common return air dry bulb temperature in °F.
   b. Operation
      1) The controller shall modulate the outside air modulating, exhaust air and return dampers in sequence to maintain the mixed air temperature setpoint 2°F (adj.) less than the discharge air temperature setpoint.
         (a) The economizer shall be enabled whenever:
            (i) Outside air temperature is less than 74°F (adj.).
            (ii) AND outside air dry bulb temperature is less than the common return air dry bulb temperature.
            (iii) AND the supply fan status is on.
            (iv) AND outside air relative humidity is less than 80% (adj.).
      2) When the unit is started in occupied mode and outside air temperature is less than 40°F (adj.), the modulating outside air damper shall ramp open to its minimum set point over a 5-minute (adj.) period and the economizer PID calculation shall be disabled. Only after this period shall the economizer PID output start calculating. When OAT is >40°F, there shall not be a delayed ramp open period.
      3) When economizer is enabled, the following operations shall be allowed to occur as needed and in the order listed to achieve mixed air temperature setpoint:
         (a) First, outside air minimum damper shall fully open.
         (b) Then, the outside air modulating damper shall modulate from closed to full open.

(c) Then, the return air damper shall modulate to fully closed. Economizer PID output shall continue to reset return damper from its controlled modulated position to achieve minimum OA and plenum pressures to fully closed, 0% open.
(d) Exhaust damper shall fully open.

4) The outside air modulating damper shall close and the return air damper shall open when:
(a) Mixed air temperature drops from 50°F (adj.) to 45°F (adj.).
(b) OR loss of supply fan on status.
(c) OR if unit is commanded off.

2. Demand Control Ventilation
a. Monitoring
1) Zone carbon dioxide levels in parts per million. Does not apply to all zones refer to plans for specific locations.
2) Outside ventilation airflow rate. (in cubic feet per minute).
3) Maximum allowable CO_2 levels: equal to outside air CO_2 concentration plus 600 ppm. This level shall be measured at 5 min. (adj.) intervals.

b. Operation
1) When not in economizer mode, unit shall operate at the demand control ventilation (DCV) minimum setpoint as indicated in the schedules with outside air minimum damper in open position.
2) If any zone air carbon dioxide levels reach the maximum allowable CO_2 levels, the modulating outside air damper shall begin to open.
3) The outside air modulating damper shall modulate from the DCV minimum setpoint to the maximum design outside air ventilation rate. The damper shall increase the outside air flow rate 10 percent (adj.) of the differential between maximum design outside air ventilation rate and DCV minimum setpoint every 1 minute (adj.).
4) If CO_2 level continues to be above maximum level the damper shall continue to open up to the maximum design outside air flowrate.
5) Once all zones are less than the maximum allowable CO_2 level the modulating outside air damper shall not open further. The damper shall remain at this flow rate until the CO_2 concentration in all zones drops below OSA concentration plus 500ppm (adj.).
6) Once the CO_2 concentration for all zones drops to outside air CO_2 concentration plus 400 ppm (adj.), the modulating outside air damper shall close.

K. Return Fan Control
1. The return fan speed shall be modulated to maintain an average zone pressurization of 0.01" w.c. (adj.) greater than the exterior reference pressure.
2. Variable speed drive shall be provided with a direct connection to the EMCS for monitoring and commanding the variable speed drive points from the EMCS workstation.

L. Morning Flush Control
1. Monitoring
a. Return air temperature
2. Operation
a. Prior to scheduled occupancy the air handling unit shall operate in 1 hour (adj.) flush mode followed by a warm up mode. In the flush mode the unit shall supply the minimum design outside ventilation air.
b. The supply air temperature setpoint shall be set to 55°F (adj.).

M. Morning Warm-Up
1. Morning warm-up shall run when the lowest indoor air temperature is less than 65°F (adj.).
2. The system shall be set to full recirculation and both outside air control dampers shall be closed. The chilled water valve shall be closed.
3. VAV boxes and reheat coil control valves shall remain fully open until the space temperature setpoint of 68°F (adj.) is achieved and then will modulate to maintain the space temperature setpoint.
4. System shall operate in this mode until internal temperatures setpoints are met at which point VAV boxes and air handling unit shall revert to normal operation.

N. Valve Failure Configuration

1. Actuation for the modulating outside air damper shall be fail closed.
2. Actuation for minimum outside air damper shall be fail open.
3. Actuation for return air modulating damper shall be fail open.
4. Actuation for exhaust air modulating damper shall be fail open.
5. Actuation for the chilled water control valve shall be fail open.
6. Actuation for the heating hot water control valve shall be fail open.

O. Refer to Zone Controls section for details of variable air volume box control.

P. Minimum Requirements for Operator Workstation Display
1. Supply fan VFD status
2. Supply fan VFD fault
3. Supply fan VFD by-pass
4. Supply fan on-off status
5. Supply fan speed
6. Supply fan static pressure setpoint
7. Supply fan static pressure (actual)
8. Supply fan high static pressure
9. Supply air airflow
10. Supply air temperature
11. Supply air temperature setpoint
12. Supply air downstream static pressure
13. Smoke Detector status
14. Return fan VFD status
15. Return fan VFD fault
16. Return fan VFD by-pass
17. Return fan on-off status
18. Return fan speed
19. Return fan high static pressure
20. Return air airflow
21. Return air temperature
22. Return air modulating damper position
23. Outside air airflow
24. Outside air modulating damper position
25. Outside air minimum damper position
26. Outside air temperature
27. Outside air relative humidity
28. Exhaust air modulating damper position
29. Chilled water return valve command
30. Heating hot water return valve command
31. Final filter status
32. Mixed air temperature

3.3 CONSTANT VOLUME PACKAGE UNIT (PAC-1)

A. General: Air handling unit shall consist of supply fan, final filter, DX coil and gas furnace.

B. Package unit shall be on emergency power.

C. Indoor Design Temperature Criteria: 66 degree F (summer) and 66 degree F (winter).

D. Operational Schedule
1. Unit shall be energized through the energy management control system (EMCS) in the automatic mode and will run 24/7 to maintain room air change requirements. DX coil or furnace will be activated to maintain the space temperature setpoint.

E. Monitor
1. Supply Fan Status: The supply fan status to be monitored via network card and current sensing relay to the EMCS.
2. Supply Fan Speed: Unit controller shall report the supply fan speed to the EMCS.
3. Supply Fan Airflow: The supply air airflow measuring station shall report the supply airflow to the EMCS.

4. Filter Status: The differential pressure sensor shall report the filter pressure drop to the EMCS.
5. Gas Valve Position: Valve position shall be reported via the control valve commanded position to the EMCS.
6. All Damper Positions: Damper positions shall be reported via the damper actuator commanded position to the EMCS.

F. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Supply Air Fan VFD Status OR VFD Alarm	Supply Air Fan Failure	Shut down supply air fan
One	Supply Air discharge static pressure exceeds 2.0 inches W.C. (adj.)	Supply Air Fan High Static	Shut down unit
Two	High zone temperature	High Zone Temperature	None – notification only.
Two	Low zone temperature	Low Zone Temperature	None – notification only.
Two	Gas valve command does not match status	Gas Valve Failure	None – notification only.
Two	Filter bank pressure differential exceeds 1-inch W.C.	Filter High Static	None – notification only.
Two	Any damper actuation failure (alarm shall specify failed damper)	Damper Failure (showing name of alarmed damper	None – notification only
Two	Outside airflow falls 10 percent below minimum for 5 minutes (adj.)	Low Ventilation Air	None – notification only

G. Fire Alarm Control

1. Activation of the area smoke detector in the space shall trigger a fire alarm. Fire alarm shall shutdown the supply fan when the alarm is activated. The wiring and conduit from the duct detector for fan shut down shall be provided.
   a. Supply Fan: OFF as controlled by fire alarm.

H. Valve Failure Configuration

1. Actuation for the modulating outside air damper shall be fail closed.
2. Actuation for minimum outside air damper shall be fail open.
3. Actuation for return air modulating damper shall be fail open.
4. Actuation for exhaust air modulating damper shall be fail open.
5. Actuation for the chilled water control valve shall be fail open.
6. Actuation for the heating hot water control valve shall be fail open.

I. Minimum Requirements for Operator Workstation Display

1. Supply fan on-off status
2. Supply fan speed
3. Supply fan static pressure setpoint
4. Supply fan static pressure (actual)
5. Supply fan high static pressure
6. Supply air airflow
7. Supply air temperature
8. Supply air temperature setpoint
9. Supply air downstream static pressure
10. Outside air temperature
11. Outside air relative humidity
12. Final filter status

3.4 LABORATORY EXHAUST FANS (EF-1, EF-2, EF-3, EF-4)

A. General

1. Unit shall run continuously and energized through the energy management control system (EMCS) in the automatic mode. The number of fans operating at any point in time will be staged to maintain the volume of air being exhausted from the building. The fans will modulate to maintain the suction static pressure determined by the Air Balancer.
2. Laboratory exhaust fan shall be on emergency power.
3. Prior to the initial start-up of the air handling units, the Laboratory Exhaust System shall be commanded to start to establish the "exhaust" flow control basis of the pressurization for the laboratory spaces.
4. The laboratory exhaust fans shall be start/stopped through the Energy Management Controls System (EMCS) based on the setting of the static pressure sensor mounted in the main exhaust air plenum on the roof level.
5. Upon system static pressure drop, the exhaust isolation dampers located on each fan inlet shall open and, when proven open, the exhaust fans shall start. Exhaust fans VFD will provide soft start only and will ramp fan speed up to the minimum VFD speed determined to be the frequency at which the nozzle outlet velocity is 3000 ft/min (adj.). The VFD speed will not drop below this value. Each following fan will start utilizing the same sequence. All fans running concurrently will run at the same speed.
6. The PID control will start to follow the system static pressure and static pressure set point. The system static pressure is maintained at the preset point of 3.5” WG (adj.). Based upon tracking position of general exhaust valves and fume hood exhaust valves, the required system static pressure set point can reset down to reduce energy consumption.
7. Each air bypass on the common fan plenum will modulate open based on the demand in air flow from the building so the fan design air flow will always be maintained constant.
8. As the need for exhaust air volume reduces, the bypass damper shall open to maintain exhaust static setpoint. When the bypass damper is 95% or more open for 3 minutes an exhaust fan will be commanded off. As the need for exhaust air volume increases the bypass damper will modulate close to maintain exhaust duct static setpoint. When the bypass damper is closed for 3 minutes an exhaust fan will be commanded on.
9. Exhaust fans shall be lead / lagged on a weekly basis. If a failure is sensed on a running fan, the lag fan will be energized. When the condition causing the failure is remedied and the unit’s alarm is reset, the original fan will energize and the lag fan will de-energize to resume normal operation.
10. On a failure of one (1) exhaust fan, the next fan in line will be commanded to start. The fan that failed shall be alarmed at the EMCS.
11. In a fire emergency, the fan VFD’s shall receive a hardwired signal from the fire alarm system to go to a field adjustable minimum speed for egress out of the laboratories. No control of this will be done via the EMCS. Exhaust fan system manifold will operate on continuous basis. General exhaust and fume hood exhaust valves will operate at minimum air flows.

3.5 NON-HOOD ROOM

A. As the static pressure in the exhaust and supply duct system fluctuates, the pressure independent cone/spring assembly of each Phoenix Venturi valve shall modulate to maintain a fixed setpoint flow within one second.

B. The Zone Balance Control function is responsible for summing the feedback of the supply and exhaust valves, factoring in the desired CFM offset value and commanding the valves under control to flow set points that satisfy the following equation: Supply = Exhaust – Offset (note: this is for a negatively pressurized room. For purposes of this sequence, we will assume a negatively pressurized room. Positively pressurized rooms operate similarly; the only difference is that you would add the offset instead of subtracting the offset). Beyond the desired ventilation rates and offset, thermal override and occupancy status may influence zone balance control to keep the space comfortable and in “balance.”

C. Temperature Control

1. A rise in temperature above the room set point flow causes the zone controller to send an increased signal to the supply valve to increase the airflow into the room. Zone pressurization is maintained by controlling the exhaust valve to a flow equal to the supply valve's feedback plus the design offset entering the space.
2. A drop in temperature below the room set point causes the supply and exhaust valves to decrease flow until their minimum positions are reached as listed on the air balance room schedules. On a further drop in zone temperature, the zone controller will drive open the heating hot water control valve serving the SAV reheat coil to maintain the temperature setpoint. Zone pressurization is maintained by controlling the exhaust valve to a flow equal to the supply valve's feedback plus the design offset entering the space.

D. EMCS Integration: Each room shall be integrated with the EMCS via PHX panel.

E. Occupancy Control: The airflow control system shall change the minimum ventilation and temperature control set points based on the occupied state to reduce energy consumption when the space is not occupied. Two occupancy modes shall be available: occupied and unoccupied. The room temperature sensor shall have a local occupancy override button that allows a user to override the occupancy mode and set the space to occupied for a predetermined interval. The local occupancy override button shall be given priority over a command from the EMCS.

F. Emergency Mode Control
1. The airflow control system shall provide a means of overriding temperature and pressurization control in response to a command indicating an emergency condition exists, and airflow control devices are to be driven to a specific flow setpoint. The system shall support up to four emergency control modes. The emergency control modes shall be initiated from the EMCS.
2. Once an emergency mode is invoked, pressurization and temperature control are overridden for the period that the mode is active. Emergency modes shall have a priority scheme allowing a more critical mode to override a previously set condition.

G. Fail-Safe Condition for Loss of Power: The valves in this application have been configured to fail in their last position under the loss of power.

3.6 VAV-HOOD ROOM

A. Variable air volume (VAV) fume hoods are each designed to exhaust an amount of air that provides a constant face velocity (100 fpm) at the sash opening regardless of sash position. As each sash opening increases or decreases, the airflow exhausted through its associated hood exhaust valve changes proportionately, thereby maintaining a constant average face velocity at the sash opening.

B. An analog exhaust valve (FEV) with High-Speed Electric Actuation (HiSEA) is used to control the exhaust flow from each fume hood. Each hood exhaust valve is configured with a factory-mounted pressure switch to detect low static pressure across the valve. Each fume hood is equipped with:
1. A fume hood monitor, which generates an alarm to alert the operator to low static pressure and flow alarm conditions, and
2. A zone presence sensor, which sets back the face velocity when the fume hood is not occupied.

C. During initial commissioning, each fume hood monitor is calibrated to maintain the relationship between sash position and exhaust airflow so that a 100 fpm face velocity is obtained.

D. The variable supply airflow is controlled with an analog supply air valve (SAV). The minimum make-up airflow is sized to satisfy the minimum ventilation rate. The make-up air valve tracks the total fume hood exhaust flow minus the desired room offset until this minimum supply air flow is reached.

E. During conditions when the laboratory experiences a high internal heat gain (caused by season, time of day, people, lights, equipment, etc.), additional supply air is required to cool the space when all fume hood sashes are at their minimum openings. The EMCS sends a cooling demand, and the supply air valve opens in response to this demand for cooling, regardless of the hoods' total exhaust demand, thereby accomplishing temperature override control.

F. Neither the large minimum ventilation airflow nor the cooling override flow can all exhaust through the fume hoods when all the sashes are at their minimum openings. Therefore, a general exhaust valve (GEV) is added to the system to remove the zone's general exhaust air. The general exhaust valve operates inversely to the total hood exhaust flow when the total hood exhaust demand is less than either the supply air minimum ventilation airflow or the temperature override airflow.

G. This control approach works to maintain the minimum ventilation airflow, to accomplish temperature control of the laboratory, and to maintain overall zone pressurization control.

H. The EMCS controls the SAV reheat coil independently to provide laboratory temperature control.

I. Sequence of Operation
   1. Zone Pressurization Control
      a. As the static pressure in the exhaust and supply duct systems fluctuates, the pressure independent cone/spring assembly of each Phoenix Venturi valve shall modulate to maintain a fixed set point flow within one second.
      b. The Zone Balance Control function is responsible for summing the feedback of all the supply and exhaust valves, factoring in the desired offset value and commanding the valves under control to flow set points that satisfy the simplified equation: Total Supply = Total Exhaust – Offset. Beyond the desired ventilation rates and offset, Zone Balance Control may also be influenced by thermal override to keep the space comfortable and in "balance".
      c. The supply valve flow command shall be generated by comparing the minimum air change demand, the supply air for hood exhaust, and the thermal demand signals, and selecting the higher of these three settings.
      d. Negative zone pressurization is maintained by controlling the GEV. The general exhaust valve shall open when additional exhaust flow is required to maintain zone pressurization.
   2. Fume Hood Control
      a. As each fume hood's sash opening increases or decreases, the sash sensor signal to the related fume hood monitor shall change proportionally. (A sash sensor and monitor are mounted on each fume hood.)
      b. The fume hood monitor shall generate a 0-10 Vdc command signal. This 0-10 Vdc linear, calibrated command signal shall control its associated hood exhaust valve, thus maintaining a constant average face velocity at the fume hood opening. Each fume hood shall operate as a conventional variable air volume hood with a conventional face velocity (i.e., 100 fpm).
      c. Each hood exhaust valve shall generate a digital feedback signal, equal to the valve's airflow in CFM, and shall send this signal to the zone control module via the room-level network.
      d. When the differential static pressure across each hood exhaust valve drops below the valve's minimum operating differential static pressure, the differential pressure switch (mounted on each hood exhaust valve) shall open, causing its associated fume hood monitor to generate an audible and visual flow alarm, indicating that the valve is outside of its control range. Upon a valve jam condition (i.e., feedback signal does not equal command signal), the fume hood monitor shall also generate a flow alarm. A mute button shall silence the audible portion of the alarm. When system conditions return to normal, all alarms shall automatically clear.
      e. When there is no user at the fume hood, the zone presence sensor (ZPS) will send a signal to the fume hood monitor to set back the face velocity to 60 fpm (60 percent of its occupied level).
   3. Temperature Control
      a. The EMCS shall control the temperature of the space. A rise in temperature above the room set point causes the system to send a cooling demand signal to the supply valve to increase the airflow into the room. Negative zone pressurization is maintained by controlling the total exhaust valve to a flow equal to the supply valve's feedback plus the design offset entering the space Exhaust Flow = Supply Flow + (Offset). This is done by adjusting the command to the general exhaust valve.

b. A drop in temperature below the room set point causes the supply and general exhaust valves to decrease flow until their minimum positions are reached as listed on the room schedule sheet. On a further drop in zone temperature, the EMCS shall command the heating hot water control valve serving the reheat coil to open.

4. EMCS Integration: Each room shall be integrated with the EMCS via PHX panel.
5. Emergency Mode Control
   a. The airflow control system shall provide a means of overriding temperature and pressurization control in response to a command indicating an emergency condition exists, and airflow control devices are to be driven to a specific flow setpoint. The system shall support up to four emergency control modes. The emergency control modes shall be initiated from the EMCS.
   b. Once an emergency mode is invoked, pressurization and temperature control are overridden for the period that the mode is active. Emergency modes shall have a priority scheme allowing a more critical mode to override a previously set condition.

J. Fail-Safe Condition for Loss of Power: The valves in this application have been configured to fail in the following manner: Under loss of power, the supply and fume hood exhaust valves will fail to their maximum scheduled limit. The general exhaust valve will fail open or closed, whichever condition leaves the room with a pressure relationship closest to normal operation. These zones fail in a negative pressurization mode with an offset similar to normal operation.

3.7 CHILLED WATER SYSTEM

A. The chilled water supply to the new science building will be supplied from the campus central loop. The central plant of the campus provides 44°F supply and 60°F chilled water return with 16°F temperature differential. A flow meter will be added in the supply line to monitor and trend the total chilled water BTU.

3.8 HEATING HOT WATER SYSTEM

A. Primary Boiler Hot Water System
   1. General
      a. The hot water system is designed to operate between 120-160 degrees F (adj.) supply water temperature.
   2. Operating Schedule
      a. Upon receiving a signal that five or more zones, or air handling unit is calling for heating for 10 minutes (adj.), the start-up sequence shall be initiated. Initial start-up signal shall be generated when valve reaches 85% open.
      b. The primary boiler shall be B-1. Boilers lead-lag assignments shall be set weekly through the EMCS based on the boiler runtime.
      c. The primary unit shall have 15 percent (adj.) greater run time than all other equipment to prevent simultaneous failure or repair for equipment by providing unequal run time for the equipment.
   3. Monitoring
      a. Boiler Status: Boiler status shall be monitored through a network control card included in the boiler controller.
      b. Boiler(s) run time: the EMCS shall track and store the run time for each boiler in hours and minutes.
   4. Alarms: - An Alarm shall be reported to the EMCS workstation for the following conditions:

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Building loop's hot water return temperature falls below 90 degrees F (adj.) AND all boilers are energized	Low loop temperature	Notification only.
Two	Primary pump status in alarm AND no flow across boiler OR pump differential pressure transducer below 4 PSI (adj.) reading OR boiler start failure	Primary pump failure	Stage on next priority pump and boiler AND shut down alarmed pump AND shut down alarmed pumps associated boiler.
Two	Boiler Trouble Alarm	Boiler start fail/Boiler Trouble	Stage on next priority boiler AND shut down alarmed boiler AND shut down alarmed boilers associated pump.

5. Hot Water Supply Temperature Reset
   a. Initial heating hot water set point shall be 160 deg F.
   b. The EMCS shall poll the position of each modulating heating hot water control valve in the HHW system every 3 minutes (adj.).
   c. The position of each valve shall be determined based upon the 0–10 VDC or 4-20mA signal that has been sent to the control valve, with 0 VDC, 4mA being closed and 10 VDC or 20mA fully open.
   d. When the maximum polled valve position has dropped below 75 percent (adj.) for a period of 5 minutes (adj.), the EMCS shall reset the temperature setpoint downwards 2 degrees F (adj.), to a minimum 120 degrees F and maintain the maximum valve position at 80 percent (adj.)
   e. When the maximum polled valve position is above 85 percent (adj.) for a period of 5 minutes (adj.), the EMCS shall reset the temperature setpoint upwards 2 degrees F to a maximum of 160 degrees F (adj.), and maintain the maximum valve position at 80 percent (adj.)
   f. The reset control function priority shall be pressure then temperature. Temperature reset shall only be used once pressure set point is at minimum.
6. Start-up
   a. Upon receiving a signal for the EMCS to energize, the master boiler controller shall fully open the lead boiler's isolation valve. Master boiler controller to signal EMCS to energize the lead primary circulation pump.
   b. The master boiler controller shall notify the EMCS of any alarms, de-energize the lead boiler and energize the next priority boiler.
7. Staging
   a. Based upon the currently assigned priority order, the boiler systems master controller shall stage on boilers when the building loop hot water temperature falls 10 degrees F (adj.) below the setpoint for more than 10 minutes (adj.).
   b. The boiler's isolation valve shall be opened by the boiler master controller.
   c. After the isolation valve has opened as determined by an end switch on the valve, the Master boiler controller shall signal EMCS to energize the primary circulation pump.
   d. The boiler systems master controller shall control boiler staging to satisfy the system setpoint.
   e. EMCS shall monitor the amount of minutes that the lead boiler has been firing; second boiler shall not fire until lead boiler has been firing for 10 minutes (adj).

f. EMCS shall monitor and compare HHW supply temperature vs HHW supply setpoint. Subsequent boilers shall not operate if primary boiler can maintain setpoint.
g. Boiler restart time shall not be less than 30 minutes (adj.) or the manufacturer's minimum requirements whichever is greater.
h. Boiler Shutdown
1) The master controller shall send the EMCS a signal whenever a boiler is staged off.
2) The second and subsequent boilers shall be staged off when the HHW return water temperature rises to within 20 degrees F of supply setpoint.
3) The EMCS shall signal the master boiler controller to close the isolation valve of the boiler that has been shut down after 5 minutes (adj. with a minimum setting of 5 minutes required).

8. Primary Pump Control: The primary pumps shall be controlled by the EMCS and shall be controlled as described in the start-up, staging and shut down sequences.
9. Shutdown
a. When there are no zones or equipment receiving a signal for heating, the EMCS shall notify the Boiler master controller to de-energize all boilers.
1) The boiler master controller shall report to the EMCS that all boilers have been de-energized.
b. Upon receiving confirmation from the boiler master controller that all boilers have been de-energized, the EMCS shall de-energize the primary pump(s) after a run time of 5 minutes (adj. with a minimum setting of 5 minutes required).
c. When pumps are de-energized, the EMCS shall signal the Boiler master controller to close the isolation valve for each boiler.
10. Minimum Requirements for Operator Workstation Display
a. Heating hot water reset supply water temperature setpoint
b. Boiler(s) On/Off status
c. System modulation level
d. Boiler(s) run time
e. Heating hot water supply temperature setpoint
f. Heating hot water supply temperature (per boiler)
g. Heating hot water return temperature (per boiler)
h. Boiler Isolation Valve(s) position.

B. Heating Hot Water System Variable Primary Control
1. General
a. Each pump is furnished with a variable speed drive.
b. Variable speed drives shall be provided with an EMCS network card for direct connection to the EMCS for monitoring and commanding variable speed drive points from the EMCS workstation.
2. Operating Schedule
a. The heating hot water pumps HHWP-1 and HHWP-2 shall be energized by the EMCS upon a call for heating.
b. The EMCS shall monitor the pump, schedule the pumps on and off to maintain the differential pressure set point.
c. The primary pump shall be HHWP-1. Pumps lead-lag assignments shall be set weekly through the EMCS based pump run time.
d. The primary unit shall have 15 percent (adj.) greater run time than all other equipment to prevent simultaneous failure or repair for equipment by providing unequal run time for the equipment.
3. Monitoring
a. Pump(s) status: Monitored through a current sensor relay in the starter bucket.
b. Pump(s) flow: The differential pressure transducer across the pump shall be monitored.
c. Pump(s) VFD Status: Monitored through the VFD status.
d. Pump(s) Speed: The VFD shall report the speed command to the EMCS.
e. Pump run time: the EMCS shall track and store the run time for each pump in hours and minutes.
4. Alarms - An Alarm shall be reported to the EMCS workstation for the following conditions:

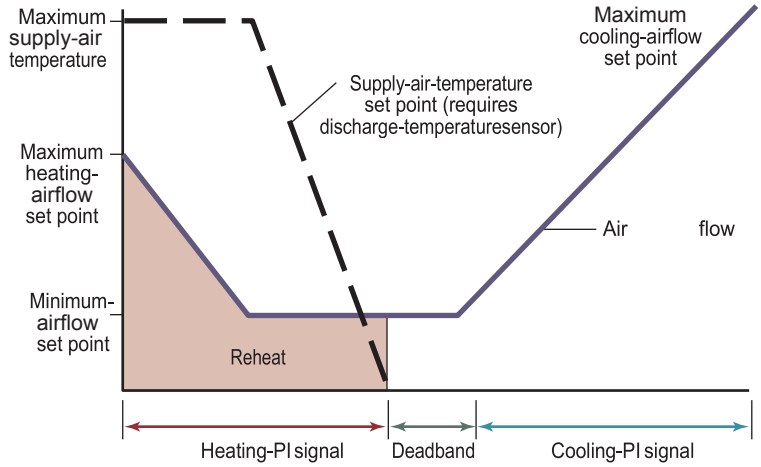
Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	VFD Status and/or Pump Differential Pressure less than 5 PSI (adj.)	Pump Failure	Shut down Alarmed Pump AND energize next priority pump.
One	Any VFD Fault	Display Fault Name received from VFD controller	Shut down Alarmed Pump AND energize next priority pump.
One	Flow meter reading less than the minimum flow rate through boiler. (minimum flow rate cumulative of the number of operating boilers)	Low water flow	Shut down pump and boiler

5. Speed Control
   a. Pressure Reset Schedule
      1) The EMCS shall poll the position of each modulating heating hot water control in the HHW system valve every 3 minutes (adj.).
      2) The position of each valve shall be determined based upon 0–10 VDC or 4-20mA signal that has been sent to the control valve, with 0 VDC, 4mA being closed and 10VDC or 20mA fully open.
      3) When the maximum polled valve position has dropped below 75 percent (adj.), the EMCS shall reset the differential pressure setpoint downwards 0.5 psi from 6 psi (adj.), and maintain the maximum valve position at 80 percent (adj.)
      4) When the maximum polled valve position is above 85 percent (adj.), the EMCS shall reset the differential pressure setpoint upwards 0.5 psi to a maximum of 6 psi (adj.), and maintain the maximum valve position at 80 percent (adj.)
   b. Staging Multiple Pumps
      1) When the speed of the lead pump reaches 85 percent (adj.) for 5 minutes, the next priority pump shall be energized slowly using PID ramp control as follows:
         (a) The EMCS shall monitor the speed signal of the lead pump and reduce the speed of the lead pump to 55 percent (adj.) of required operating speed as determined by the system curve.
         (b) The lag pump shall ramp up to meet the speed signal of the lead pump.
         (c) Both pumps shall be ramped up together until the differential pressure setpoint has been satisfied. Both pumps are controlled to the speed signal of the lead pump.
         (d) Both pumps will continue to run until both pumps are below 50 percent (adj.) for 5 minutes (adj.). The lag pumps shall ramp down slowly and let the lead pump ramp back up to meet the differential pressure setpoint.
6. Loop Monitoring
   a. Heating hot water supply and return water temperature shall be monitored by the EMCS.
   b. The EMCS shall monitor and record the heat hot water consumption from the energy meter located in the heating hot water loop.
   c. The EMCS shall monitor the flow rate in the primary loop.
7. Valve Actuation
   a. The EMCS shall schedule valve exercise for the heating hot water control valve once every three days during unoccupied hours and during occupied hours every third day prior to shut down of the primary pumps to allow circulation throughout the system.
      1) Each valve shall be sent a signal to fully open and close as part of the valve exercising.
   b. Actuation for the heating hot water control valves shall be fail open.
      1) Valves shall be actuated on central air handling units and boilers followed by zone valves.

8. Minimum Requirements for Operator Workstation Display
    a. Heating hot water supply temperature setpoint
    b. Heating hot water supply temperature
    c. Heating hot water return temperature
    d. Heating hot-water pump(s) on-off status.
    e. Heating hot-water pump(s) VFD speed.
    f. Heating hot-water differential pressure setpoint
    g. Heating hot-water differential pressure
    h. Heating hot-water primary flow rate
    i. Pump(s) run time.

3.9 ZONE CONTROLS

A. Variable Air Volume Terminal Units
1. General: Room temperature sensor shall modulate the VAV airflow and HHW control valve to maintain room temperature setpoint: 76 ± 2 °F (cooling and 68 ± 2 °F (heating), (adj.) utilizing a dual maximum control strategy.
2. Monitoring
    a. Space Temperature: The EMCS shall continuously monitor the space temperature from the zone thermostat.
    b. Space Airflow: The VAV controller shall continuously report the zone airflow.
    c. Damper Position: The VAV damper position shall be reported to the EMCS every 3 minutes (adj.).
3. Airflow Control Damper: EMCS shall continuously monitor supply air flow via duct mounted air volume control unit and modulate the integral control damper to maintain space setpoint.
4. Control
    a. When the zone is in the cooling mode, the cooling loop output is mapped to the airflow setpoint from the cooling maximum to the minimum airflow setpoints. The heating hot water valve is closed.
    b. When the zone is in the deadband mode, the airflow setpoint shall be the minimum airflow setpoint. The heating hot water valve is closed.
    c. When the zone is in the heating mode, the heating loop shall maintain space temperature at the heating setpoint as follows:
        1) From 0%-50% loop signal, the heating loop output shall reset the supply air temperature setpoint (e.g., 55°F) to 90°F and zone airflow at minimum airflow. Note the upper temperature is limited to prevent stratification during heating.
        2) From 50%-100% loop signal, the heating loop output shall reset the zone airflow setpoint from the minimum airflow setpoint to the maximum heating airflow setpoint. The supply air discharge temperature remains at 90°F.
    d. The hot water valve shall be modulated using a PI control loop to maintain the discharge temperature at setpoint. Note that directly controlling the hot water valve from the zone temperature PI loop is not acceptable since it will not allow supply air temperature to be under control and limited in temperature to prevent stratification.
    e. The VAV damper shall be modulated to maintain the measured airflow at setpoint.
5. VAV Control Diagram



6. Demand Control Ventilation: If zone air carbon dioxide levels reach the maximum allowable CO_2 levels, associated zone terminal unit minimum position shall be reset to the maximum heating airflow setpoint. If the allowable CO_2 levels continue to not be met, the terminal unit shall continue to open at a rate of 10% per minute until the CO_2 concentration for all zones drops to outside air CO_2 concentration plus 500 ppm the zone terminal unit normal control.
7. Minimum Requirements for Operator Workstation Display
   a. Space setpoint temperature
   b. Space temperature
   c. VAV damper position
   d. VAV airflow
   e. Heating hot water valve position
8. Unoccupied Hours Setback Control
   a. If the space temperature rises above 85°F (adj.), the zone controller shall signal the EMCS that cooling is required. The EMCS shall initiate the associated AHU and operate until the space temperature reaches 78°F (adj.).
   b. If the space temperature drops below 60°F (adj.) and the outside air temperature is less than 55°F (adj.), the zone controller shall signal the EMCS that heating is required. The EMCS shall initiate the associated AHU and operate until the space temperature reaches 65°F (adj.).

B. Fan Powered Terminal Units (FPTU)
1. General
   a. The fan shall operate continuously during occupied hours to provide ventilation/make-up air and heating to the space.
2. Operational Schedule
   a. Unit shall be energized through the energy management control system (EMCS) in the automatic mode based on the following adjustable schedule:

1) Weekday:	7:00 a.m. to 5:59 p.m.	Occupied
	6:00 p.m. to 6:59 a.m.	Unoccupied
2) Saturday:	7:00 a.m. to 5:59 p.m.	Occupied
	6:00 p.m. to 6:59 a.m.	Unoccupied
3) Sunday:	12:00 a.m. to 11:59 a.m.	Unoccupied
4) Holiday:	12:00 a.m. to 11:59 a.m.	Unoccupied

3. Monitoring
   a. Space Temperature: the EMCS shall continuously monitor the space temperature from the zone thermostat
   b. Space airflow: the FPTU controller shall continuously report the zone airflow.
4. Reheat
   a. On a call for heating, the room temperature sensor shall modulate the hot water reheat valve to maintain the discharge air temperature setpoint of 82°F (adj.).
5. Zone Override

a. Each zone thermostat shall be provided with push button override. The push button override shall energize the respective air handling unit and provide operation for an override time period of 3 hrs (adj.).

6. Minimum Requirements for Operator Workstation Display:
   a. Space set point temperature
   b. Space temperature
   c. Supply air temperature set point
   d. Supply air temperature
   e. Associated AHU supply air temperature
   f. Primary actuator position
   g. Total Supply air airflow
   h. Reheat coil valve position
   i. Override status
   j. Fan Status

C. Fan Coil Unit (FCU-1-3, FCU-1-4)

1. Operation: Fan coil unit shall cycle with the space load to maintain the space temperature setpoint. The units shall operate on occupied hours.
2. Operational Schedule
   a. Unit shall be energized through the energy management control system (EMCS) in the automatic mode based on the following adjustable schedule:

1) Weekday:	7:00 a.m. to 5:59 p.m.	Occupied
	6:00 p.m. to 6:59 a.m.	Unoccupied
2) Saturday:	7:00 a.m. to 5:59 p.m.	Occupied
	6:00 p.m. to 6:59 a.m.	Unoccupied
3) Sunday:	12:00 a.m. to 11:59 a.m.	Unoccupied
4) Holiday:	12:00 a.m. to 11:59 a.m.	Unoccupied

3. Monitor
   a. Supply Fan Status: A current sensor located in the starter bucket shall report the fan status.
   b. Discharge air temperature: Monitor discharge air temperature via temperature sensor.
   c. Condensation sensor: The EMCS shall continuously monitor the condensation sensor in the drain pan.
   d. Space Temperature: The EMCS shall continuously monitor the space temperature from the zone thermostat.
4. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Supply fan status failure	FCU failure	Shutdown alarmed FCU
One	Upon detection of moisture in the secondary drain pan by the moisture sensor mounted in the unit	Condensate drain failure	De-energize alarmed unit
Two	When the space temperature rises above 85°F (adj.)	High Temperature Alarm	Notification only.

5. Supply Fan: The supply fan shall be energized through the EMCS.
6. Supply Air Temperature Control
   a. Modulate chilled water control valve to maintain supply air setpoint.
   b. Setpoint Schedule (all adjustable)

Unit	Cooling
Electrical Rooms	80 degrees F

D. Variable Refrigerant Volume (VRV) System
   1. Operation
      a. VRV System shall be energized through the energy management control system (EMCS) in the automatic mode and shall operate continuously.
      b. All VRV fan coil units shall cycle with the space load to maintain the space temperature set point. The fan coil units shall interface with associated heat pump condensing unit to provide cooling and can operate 24 hours a day.
      c. Operation control points
         1) System on/off command
         2) Operating mode
         3) Temperature set point
         4) Air flow rate (fan speed)
         5) Filter indicator reset
   2. Monitor
      a. System on/off status
      b. Operation mode status
      c. Temperature setpoints
      d. Room temperature
      e. Airflow rate
      f. Filter indication status
      g. Error status
   3. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Supply fan status failure	FCU failure	Shutdown alarmed FCU
One	Upon detection of moisture in the secondary drain pan by the moisture sensor mounted in the unit,	Condensate drain failure	De-energize alarmed unit
Two	When the space temperature rises above 80°F (adj.)	High Temperature Alarm	Notification only.

   4. Supply Air Temperature Control
      a. Setpoint Schedule (all adjustable)

Unit	Cooling
BDF/IDF	75 degrees F
Elevator Machine Room	75 degrees F

3.10 FAN SYSTEMS

A. Exhaust Fans with Schedule Control (TEF-1)
   1. Operational Schedule

a. Unit shall be energized through the energy management control system (EMCS) in the automatic mode and shall be interlocked with AHU-3.

2. Monitor
   a. Exhaust Fan Status: Current sensing relay mounted in the fan starter bucket and report to EMCS.
3. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Exhaust Fan Status	Exhaust Fan Failure	Shut down alarmed fan.

B. Supply Fan with Schedule Control (SF-5)
1. Operational Schedule
   a. Unit shall be energized through the energy management control system (EMCS) in the automatic mode and shall be interlocked with AHU-1.
2. Monitor
   a. Supply Fan Status: Current sensing relay mounted in the fan starter bucket and report to EMCS.
3. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Supply Fan Status	Supply Fan Failure	Shut down alarmed fan.

C. Exhaust Fans with Schedule Control (EF-6)
1. Operational Schedule
   a. Unit shall be energized through the energy management control system (EMCS) in the automatic mode and shall be interlocked with the laser cutter equipment.
2. Monitor
   a. Exhaust Fan Status: Current sensing relay mounted in the fan starter bucket and report to EMCS.
3. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Exhaust Fan Status	Exhaust Fan Failure	Shut down alarmed fan.

3.11 MISCELLANEOUS SYSTEMS

A. Chimney Automation System (BEF-01, BEF-02)
1. Operation
   a. EMCS shall monitor the chimney automation system status via a dry contact in the chimney automation system control panel (CONTROL).
   b. Each boiler shall be interlocked with the CONTROL. Upon a call for heat, the CONTROL will activate the power venter to establish draft in the chimney system. Once draft setpoint is reached, the boiler proceeds to ignition. This sequence is repeated every time the boiler calls for heat without the CONTROL interrupting the sequencing of the boilers.

c. When a boiler shuts down, its gas valve is immediately closed. The power venter will slow down to satisfy the draft setpoint. Once the last boiler has shutdown, the power venter will continue to run in post purge mode for a set period of time to remove residual flue gases.
d. If proper draft cannot be maintained because of a mechanical or electrical failure, the CONTROL will go into alarm mode and the integrated proven draft function will shut down all boilers within 15 seconds and gas valves immediately closed. While in alarm mode, the control constantly monitors the draft. If the failure corrects itself or is corrected via intervention, the system will restart automatically.
e. If the power venter is out of commission for seven consecutive days, the bearing cycle activation function will allow the fan to operate at a low speed for a short time. This is automatically repeated every seven consecutive days the chimney fan does not operate.

2. Monitor:
   a. Chimney Automation System status for any alarm.

B. Plumbing Equipment
1. Monitoring: The EMCS shall monitor the following plumbing equipment:
   a. Domestic Hot Water Heater: On/Off operation monitored through runtime contacts on the domestic water pump.
   b. Domestic Hot Water Recirculation Pump: On/Off operation monitored through runtime contacts or relay on the domestic water pump.
   c. Domestic Water Booster Pump: On/Off operation monitored through contacts from pump control panel.
   d. Laboratory Air Compressor: On/Off operation monitored through contacts from pump control panel.
   e. Laboratory Vacuum Pump: On/Off operation monitored through contacts from pump control panel.
   f. Pure Water Equipment: On/Off operation monitored through contacts from pump control panel.
   g. pH Monitoring System: On/Off operation monitored through contacts from pH monitoring control panel.
2. Safeties and Alarms

Alarm Priority	Alarm Conditions	Alarm Reported	Action
One	Domestic Hot Water Heater alarm contact closes.	Domestic Hot Water heater failure	None – notification only.
One	Air Compressor alarm contact closes.	Air Compressor failure	None – notification only.
One	Domestic Hot Water Circulation Pump alarm contact closes.	Domestic Hot Water Pump failure	None – notification only.
One	Vacuum Pump alarm contact closes.	Vacuum Pump failure	None – notification only.
One	Domestic Water Booster Pump alarm contact closes.	Domestic Water Booster Pump failure	None – notification only.
One	Pure Water System alarm contact closes.	RO/DI equipment failure	None – notification only.
One	Greenhouse Pure Water System alarm contact closes.	Greenhouse DI equipment failure	None – notification only.
One	Emergency Generator alarm contact closes.	Emergency Generator equipment failure	None – notification only.

C. Metering Equipment

1. The EMCS shall monitor and track the following meters:
   a. Domestic Water meter.
   b. Greenhouse Domestic Water meter.
   c. Industrial Water meter.
   d. Natural Gas meter.
   e. Irrigation Water meter.
   f. Pure Water meter.
   g. Greenhouse pure water meter.
   h. Chilled Water meter.
   i. Heating Hot Water meter.
   j. Heating Hot Water system make-up water.

D. Sampling Box pH monitoring system
   1. The EMCS shall monitor and track the quality of laboratory waste discharge.

END OF SECTION

SECTION 232123
HYDRONIC PUMPS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Close coupled, base-mounted, end-suction centrifugal pumps.

B. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.3 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
   1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

D. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated. Refer to Section 016000 – PRODUCT REQUIREMENTS.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Owner's Representative and marked for intended use.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

E. Each pump with motor in 5hp or larger shall be factory tested per Hydraulic Institute Standards prior to shipment. Pump selections with flat curves shall not be permitted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal(s) for each pump.

1.8 WARRANTY

A. Manufacturer agrees to repair or replace pump that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of ~~Substantial~~ Final completion. **ADD-3**

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

2.2 CLOSE COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. Manufacturers

1. Bell & Gossett; Div. of ITT Industries.
2. Armstrong Pumps Inc.
3. Taco, Inc.
4. Or equal.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for 175 psig minimum working pressure and a continuous water temperature of 225 degrees F.

C. Pump Construction

D. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections.

1. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw.
2. Pump Shaft: Stainless steel.
3. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
4. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.

E. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36 / A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

F. Bearings shall be selected for a minimum L10 life of 200,000 hours at maximum catalogued operating speed.

G. Motor: Single speed and rigidly mounted to pump casing with integral pump support.
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.
      a. Enclosure: Totally enclosed, fan cooled.
      b. Enclosure Materials: Cast iron.
      c. Motor Bearings: Permanently lubricated ball bearings.
      d. Efficiency: Premium efficient.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Section 230500 – COMMON WORK RESULTS FOR HVAC.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.3 PUMP INSTALLATION

A. Comply with HI 1.4 for centrifugal pumps

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

E. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

F. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

G. Support pump fittings with floor mounted pipe and flange supports.

3.4 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, non-metallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.5 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

F. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.

G. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve, shut off valve and balancing valve on pump discharge, balancing valve shall be omitted on pumps with variable speed drives.

H. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For in-line, close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

I. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

J. Connect wiring according to Section 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

K. Millwright, with minimum 10 years experience in the trade, shall check, align and certify base mounted pumps prior to start-up and certification provided.

3.6 STARTUP SERVICE

A. Check piping connections for tightness.

B. Clean strainers on suction piping.

C. Perform the following startup checks for each pump before starting:
1. Verify bearing lubrication.
2. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

3. Verify that pump is rotating in the correct direction.

D. Prime pump by opening suction valves and closing drains, and prepare pump for operation.

E. Start motor.

F. Open discharge valve slowly.

3.7 DEMONSTRATION

A. Train the Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Section 017900 – DEMONSTRATION AND TRAINING.

END OF SECTION

SECTION 232500
HVAC WATER TREATMENT

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following HVAC water-treatment systems:
   1. Bypass chemical-feed equipment and controls.
   2. Chemical treatment test equipment.
   3. HVAC water-treatment chemicals.
   4. Water filtration units for HVAC makeup water.

1.2 DEFINITIONS

A. EEPROM: Electrically erasable, programmable read-only memory.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

C. RO: Reverse osmosis.

D. TDS: Total dissolved solids.

1.3 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including but not limited to hot-water heating, shall have the following water qualities:
   1. pH: Maintain a value within 9.0 to 10.5.
   2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
   3. Boron: Maintain a value within 100 to 200 ppm.
   4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
   5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
   6. TDS: Maintain a maximum value of 10 ppm.
   7. Ammonia: Maintain a maximum value of Insert number ppm.
   8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
   9. Microbiological Limits:
      a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
      b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
      c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
      d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
      e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
   1. Bypass feeders.

B. Shop Drawings: Pretreatment and chemical, treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections,

details, and attachments to other work.

1. Wiring Diagrams: Power and control wiring.

C. Field quality-control test reports.

D. Manufacturer Seismic Qualification Certification: Submit certification that water filtration units and components will withstand seismic forces defined in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Operation and Maintenance Data: For sensors, injection pumps, water filtration units, and controllers to include in emergency, operation, and maintenance manuals.

F. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
2. Water Analysis: Illustrate water quality available at Project site.
3. In accordance with project submittal requirements, submit a proposed schedule for routine treatment control and reporting for all affected systems for the entire year.
4. Submit reports indicating that the piping systems have been properly cleaned, and that start-up of all treatment systems has been completed, and all systems are operating properly.
5. Submit reports indicating initial analysis and status of system water after cleaning, and after charging of treatment chemicals.
6. Submit monthly status reports, with a copy to the Owner’s Representative indicating all findings on jobsite visits, chemical residual balances and any chemicals added, including quantities for the record. Note any discrepancies including leakage which may be causing chemical residuals to decay faster than normal and equipment which is not working properly. Note maintenance procedures which could be improved if needed so that the program can be optimized.
7. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Owner’s Representative.

1.5 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for hot-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of ~~Substantial~~ Final Completion, and shall include the following: **ADD-3**

1. Initial water analysis and HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

B. Provide monthly technical service visits to perform field inspections and make water analysis on site.

C. Service Companies
   1. Chem-pro.
   2. Or equal.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wingert **ADD-3**
   ~~1.~~2. Anderson Chemical Co, Inc.
   ~~2.~~3. Aqua-Chem, Inc.; Cleaver-Brooks Div.
   ~~3.~~4. GE Betz.
   ~~4.~~5. H-O-H Chemicals, Inc.
   ~~5.~~6. ONDEO Nalco Company.
   ~~6.~~7. Or equal.

2.2 MANUAL CHEMICAL-FEED EQUIPMENT

A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
   1. Capacity: 5 gal.
   2. Minimum Working Pressure: 125 psig.

2.3 STAINLESS-STEEL PIPES AND FITTINGS

A. Stainless-Steel Tubing: Comply with ASTM A 269, Type 316.

B. Stainless-Steel Fittings: Complying with ASTM A 815/A 815M, Type 316, Grade WP-S.

C. Two-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, carbon-filled TFE seats, threaded body design with adjustable stem packing, threaded ends, and 250-psig SWP and 600-psig CWP ratings.

2.4 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

B. The water treatment contractor shall provide all necessary and proper chemicals to operate the systems for a period of two years from initial operation. The following shall be included:
   1. Cleaning chemicals, in liquid form, for cleaning of the system.
   2. Systems shall be treated with a borate nitrite compound. The following residuals shall be maintained:
      a. 600-800ppm nitrite in hot water heating systems.
      b. 400-600ppm nitrite in chilled water systems.
   3. Biocide
      a. Supply and install chemicals as recommended for the local water quality.

PART 3 EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Refer Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT for seismic restraints.

C. Install water testing equipment on wall near water chemical application equipment.

D. Install interconnecting control wiring for chemical treatment controls and sensors.

E. Mount sensors and injectors in piping circuits.

F. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, equipped with the following:

1. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
2. Install water meter in makeup water supply.
3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
4. Install a full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
5. Install a swing check on inlet after the isolation valve.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Section 230500 – COMMON WORK RESULTS FOR HVAC.

D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 – GENERAL DUTY VALVES FOR HVAC PIPING.

E. Refer to Section 221119 – DOMESTIC WATER PIPING SPECIALTIES, for backflow preventers required in makeup water connections to potable-water systems.

F. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.

G. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

H. Connect wiring according to Section 260519 – LOW VOLTATE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.4 CLEANING SEQUENCE

A. Prior to system fill disconnect flexible hoses at each coil and connect together to bypass coil. Continue with hoses in this configuration until system has been completely flushed and cleaned when coils shall be reconnected.

B. Add cleaner to open and closed systems at concentration as recommended by manufacturer but not less than one pound per 100 gallons of water for hot systems and one pound per 50 gallons of water for cold systems.

C. Cooling and Heating Systems: Circulate for 48 hours, then drain systems as quickly as possible. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed.

D. Flush the system of all pipe slag and particulate matter.

E. Fill the system with hot water (140°F) and add a solution of hypochlorite as recommended by the manufacturer. Circulate the system for 24 hours. Blowdown and clean out all the strainers.

F. Drain the system and fill with required water.

G. Use neutralizer agents on recommendation of system cleaner supplier.

H. Flush open systems with clean water for one hour minimum. Drain completely and refill.

I. Remove, clean, and replace strainer screens.

J. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
   2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
   3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
   4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
   5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
   7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
   8. Repair leaks and defects with new materials and retest piping until no leaks exist.

D. Remove and replace malfunctioning units and retest as specified above.

E. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising the Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at four-week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.

F. At four-week intervals following ~~Substantial~~ Final Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Article 1.4 above. **ADD-3**

G. Comply with ASTM D 3370 and with the following standards:
   1. Silica: ASTM D 859.
   2. Steam System: ASTM D 1066.
   3. Acidity and Alkalinity: ASTM D 1067.
   4. Iron: ASTM D 1068.
   5. Water Hardness: ASTM D 1126.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain HVAC water treatment systems and equipment. Refer to Section 017900 – DEMONSTRATION AND TRAINING.

END OF SECTION

SECTION 233423
HVAC POWER VENTILATORS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. In-line centrifugal fans.
   2. Centrifugal roof ventilators.

B. Related Sections
   1. See Commissioning Requirements Section 019113.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations above sea level.

B. Selected fans shall be capable of accommodating static pressure and flow variations of plus or minus 15 percent of scheduled values.

C. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Fan speed controllers.
   7. Manufacturer's certificate: Certify products meet or exceed specified requirements.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring.
   2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved
   1. Roof framing and support members relative to duct penetrations.
   2. Ceiling suspension assembly members.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

1.4 FIELD QUALITY-CONTROL TEST REPORTS.

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

B. LEED Submittal

1. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Owner's Representative, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: Two sets for each belt-driven unit.
2. Sheaves: One extra set of fixed sheaves.

1.9 WARRANTY

A. Manufacturer agrees to repair or replace equipment/device/component that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of ~~Substantial~~ Final completion. **ADD-3**

PART 2 PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Greenheck.
2. Loren Cook Company.

3. Penn Ventilation.
1. Or equal.

B. Description: In-line, direct-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted outside airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components.

G. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum L10 life in excess of 200,000 hours at maximum catalogued operating speed.

H. Drives shall be sized for a minimum of 150 percent of driven horsepower.

I. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

J. Motor pulleys shall be adjustable for final system balancing. A NEMA 1 disconnect switch shall be provided as standard. Factory wiring shall be provided from motor to the handy box.

K. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

L. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

M. Accessories
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Greenheck.
2. Loren Cook Company.
3. Or equal.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain drains.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

2.3 MATERIAL HANDLING RADIAL BELT DRIVE BLOWERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Greenheck.
   2. Loren Cook Company.
   3. Or equal.

B. Housing:
   1. Process or material handling fans shall be of the heavy duty type with the inlet diameters and outlet areas manufactured in accordance with the standards adopted by AMCA for industrial fans.
   2. Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence
   3. The housings on all fan sizes shall be of continuously welded heavy gauge steel. All interior and exterior surface steel shall be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be gray. No uncoated metal fan parts will be allowed.
   4. Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings
   5. Either an OSHA compliant weatherhood, or a combination of an OSHA compliant belt guard and shaft guard shall be included to completely cover the motor pulley and belt(s)

C. Fan Wheels:
   1. The fan wheel shall be of the radial type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
   2. Fan wheel shall be manufactured with continuously welded steel blades and coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be industrial gray.
   3. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

D. Accessories:
   1. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
   2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
   3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

E. Fan Motors and Drive:
   1. Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service.
   2. Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
   3. Fan shaft bearings shall be Air Handling Quality, bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type.
   4. Air Handling Quality bearings to be designed with low swivel torque to allow the outer race of the bearing to pivot or swivel within the cast pillow block. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration.

2.4 MOTORS

A. Comply with requirements in Section 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.

2.5 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

2.6 VARIABLE FREQUENCY DRIVES

A. General: Furnish complete individual variable frequency VFDs for each fan designated on the drawing schedules to be variable speed with requirements in Section 262923 VARIABLE FREQUENCY MOTOR CONTROLLERS.

B. Install VFD in a panel to avoid LCD screen from fading.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.

C. Support suspended units from structure using threaded steel rods and vibration isolators having a static deflection as shown on the contract drawings. Vibration-control devices are specified in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT.

D. Install fans with clearances for service and maintenance.

E. Label fans according to requirements specified in Section 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.

F. All exhaust and outside air equipment shall incorporate dampers that automatically close during periods of non-use. The dampers shall be either motorized or gravity type.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 – AIR DUCT ACCESSORIES.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Install line-sized piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.

D. Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Install fan restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

F. Install fans with flexible electrical leads.

G. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

H. Connect wiring according to Section 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Refer to Section 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC for testing, adjusting, and balancing procedures
10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Section 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 235100
BREECHINGS, CHIMNEYS, AND STACKS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Listed Special gas vents.
   2. Field-fabricated metal breechings and chimneys.

B. Related Sections include the following:
   1. Section 235113 – Draft Control Devices for induced draft and mechanical fans and for motorized and barometric dampers.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Special gas vents.

B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
   2. For installed products indicated to comply with design loads, include calculations required for selecting seismic restraints and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Manufacturer Seismic Qualification Certification: Submit certification that factory-fabricated breeching, chimneys, and stacks; accessories; and components will withstand seismic forces defined in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT, include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   2. Dimensioned Outline Drawings of Breeching, Chimneys, and Stacks: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of anchorage devices on which the certification is based and their installation requirements.

C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to AWS D1.1 / D1.1M, "Structural Welding Code – Steel," for hangers and supports and AWS D9.1 / D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.

C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

1.5 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 – ROOF ACCESSORIES.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.

1. Warranty Period: **10** years from date of ~~Substantial~~ FInal Completion. **ADD-3**

PART 2 PRODUCTS

2.1 LISTED SPECIAL GAS VENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Security Chimneys Type SSD Secure-Seal
2. Heat-Fab-Fab, Inc. Type CI-Plus
3. Selkirk Inc.
4. Or equal.

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 degrees F continuously, with positive or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1 -inch airspace.

D. Joint method will be male/female overlapping utilizing Viton O-Ring seal for joint seal. Use of Silicon as a joint gasket is prohibited.

E. Inner Shell: ASTM A 959, Type 29-4C stainless steel.

F. Outer Jacket: 440 series Stainless steel.

G. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

2.2 GUYING AND BRACING MATERIALS

A. Cable: Three galvanized, stranded wires of the following thickness:

1. Minimum Size: 1/4-inch in diameter.
2. For ID Sizes 4 to 15 Inches: 5/16-inch.
3. For ID Sizes 18 to 24 Inches: 3/8-inch.

B. Pipe: Three galvanized steel, NPS 1-1/4.

C. Angle Iron: Three galvanized steel, 2 by 2 by 0.25-inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Listed Special Gas Vent: Condensing gas appliances; water heaters and boilers.

3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

C. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

D. Lap joints in direction of flow.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.

C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION

SECTION 235105
CHIMNEY AUTOMATION SYSTEM

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install a packaged Chimney Automation System and related equipment as shown on the drawings and as specified, complete, including the following:
   1. Packaged ETL listed chimney fan/control combination, listed to UL 378, Standard for Draft Equipment as a complete system.
   2. Electrical connections.
   3. Stack connection.

1.2 RELATED SECTIONS

A. See Commissioning Requirements Section 019113.

1.3 CODES AND STANDARDS

A. In addition to Section 230000, BASIC MECHANICAL REQUIREMENTS, the following published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section:
   1. UL – Underwriters Laboratories
   2. National Electrical Code

1.4 QUALITY ASSURANCE

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture and shall be of a standard catalog product.

B. Draft system guaranteed to operate satisfactory and efficiently without objectionable smoke or odor.

C. Scheduled equipment performance is minimum capacity required.

D. Scheduled electrical capacity shall be considered as maximum available.

E. Equipment to be manufactured at ISO 9001 certified plant.

1.5 SUBMITTALS

A. System vendor shall coordinate equipment product data submittal sheets and shall provide a comprehensive set of interfaced drawings which shall serve as the basis for system evaluation by consulting engineer.

B. Submit the following to the Owner's Representative.
   1. Comprehensive set of mechanical venting calculations based on the Chimney Design Equation published in the ASHRAE Handbook. Calculations must show flue gas volumes, pressure losses, fluctuations in natural draft at different loads and seasonal temperatures as well as estimated temperatures in each venting section to assure compliance with fan temperature rating and detect potential condensation issues. The total draft range must be documented by mechanical venting calculations based on the actual ASHRAE degree range for the geographical location of the installation. The calculations must show the draft over the entire firing range at low, medium and high design temperatures.
   2. Power venter descriptive literature, dimensional diagram and electrical diagram.
   3. Control descriptive literature, dimensional diagrams and electrical diagrams.
   4. Specification review with respect to submitted equipment identifying all areas of compliance and exceptions.
   5. Certification of listing by nationally recognized testing laboratory.

C. Manufacturers not named in these specifications, but those that have received prior approval by the consulting engineer as required within 10 days prior to bid date, shall be permitted one opportunity to receive formal submittal approval. If this approval is not granted by the consulting engineer, the contractor shall submit on the manufacturer name in these specifications only or the contractor will be charged for the submittal review time for alternate manufacturers.

D. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.6 QUALITY ASSURANCE

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture and shall be of a standard catalog product.

B. Mechanical draft system guaranteed to operate satisfactory and efficiently and to provide a constant draft that does not fluctuate more than +/- 0.01" W.C. under stable load conditions.

C. Scheduled equipment performance is minimum capacity required.

D. Scheduled electrical capacity shall be considered as maximum available.

E. Equipment to be manufactured at ISO 9001 certified plant.

1.7 OPERATING AND MAINTENANCE MANUALS

A. Provide to Owner's Representative complete Operation and Maintenance manuals with product literature on the chimney fan and controls, dimensional and wiring diagrams.

1.8 MANUFACTURERS' WARRANTY

A. All equipment is to be guaranteed against defects in materials and / or workmanship for a period of 2 years from date of ~~substantial~~ final completion. The warranty shall be provided by the equipment vendor and shall include the parts necessary to repair or replace all defective parts and materials. **ADD-3**

B. The chimney fan is covered by a 10-year warranty against corrosion perforation.

PART 2 PRODUCTS

2.1 MANUFACTURERS, CHIMNEY AUTOMATION SYSTEMS

A. Furnish ENERVEX Chimney Automation System with design volume and design pressure as scheduled on the drawings or equal. The entire system must conform to UL378, Standard for Draft Equipment and bear a certification mark from ETL or other nationally recognized testing laboratory.

B. Alternate manufacturers complying with plans and specifications must be submitted and approved by the consulting engineer within 10 days prior to bid date.

2.2 CHIMNEY AUTOMATION SYSTEM DESIGN

A. The power venter design shall be of a true inline design with intake and exhaust centered on a horizontal axis. It shall be a Type B, Spark Resistant Construction in compliance with AMCA Standard 99-0401. The power venter housing shall be type 316L stainless steel with a minimum thickness of 0.063". The power venter shall be of the direct drive design and rated for use with temperatures up to 660°F (350°C). The drive unit consisting of the impeller and the motor shall be removable from the housing without having to remove the entire fan from the chimney system. The power venter must be listed for use with all types of heating appliances and this shall be acknowledged in the installation manual.

B. The backward inclined impeller shall be made in non-ferrous material to eliminate the possibility of sparks and the potential of igniting unburned fuel and/or explosive gases. It must be balanced statically and dynamically with balancing weights being an integral and non-removable part of the impeller.

C. The motor shall be a maintenance-free, variable speed motor with pre-lubricated and sealed ball bearings. The motor shall be factory warranted by the power venter manufacturer to operate at frequencies as low as 8Hz for three-phase motors. The bearings shall be of a high temperature type with a minimum rating of 320°F (160°C). The motor is mounted outside the airstream and shall be at least Class A insulated with a temperature rating of min. 221°F (105°C) and rated as shown on schedule. The motor shall be a totally enclosed, fan-cooled (TEFC) motor. To assure motor longevity the motor shall be inverter-duty rated and not operate at speeds above 1740 RPM.

D. The modulating fan control, MEC18 provided with TRIAC board module, must be a true PID-based control with infinitely variable speed settings and in a NEMA 1 rated enclosure. It shall interfere with the operation of the heating appliances by preventing burner operation during emergencies where a mechanical or electrical problem occurs. The features must be part of the compliance with UL378, Standard for Draft Equipment and UL508, Standard for Industrial Controls:
   1. “Plug-and-Play” self-check that detects connections, setting requirements and accessories during each start-up.
   2. Programmable microprocessor for selective programming of, but not limited to, draft, intermittent vs. continuous fan operation, purge times, sensor sensitivity, alarm limits and delays, manual overrides, low/high limit fan speeds via the operating panel or the RS-232 port.
   3. A standard board that interlocks with up to 6 boilers/appliances so a call for heat activates the power venter and releases the individual burner once the pre-set draft has been established.
   4. An integrated and programmable proven draft function that can be set for automatic and manual reset.
   5. An integrated Operating Priority option, which allows one or more appliances to operate during electrical or mechanical failure of the fan, provided the draft requirement can be met and safe operation assured. Set up of a default Operating Priority must be possible, so the most important appliance(s) have highest priority during calls for heat. It must automatically check for fan operation every two hours and go back to normal operation if appropriate.
   6. Bearing cycle activation every 7 days if the power venter has not been operating during the past 7 day period.
   7. A normally open (NO) contact is available within the control to activate a visual or audible alarm (by others), or to interlock with a Building Management System.
   8. An alarm function that will display the fault code on the LED display and signal an audible alarm. The control shall log the last 10 fault codes.

E. The pressure sensor, XTP2, must be certified for use with oil- or gas-fired appliances and shall include a chimney probe along with tubing for installation in the chimney or stack as shown on the manufacturer’s submittal and feature:
   1. The temperature drift shall be less than +/- 1.0% full scale, the offset longtime drift (1 year) shall not exceed +/- 0.003 inWC (0.7Pa) and the sensor response time shall be less than 0.2 seconds.

F. A variable frequency drive, ABB Model Ach550, listed to UL508 and listed and programmed as part of the mechanical draft system. The VFD shall not be part of the PID-loop.
   1. All features shall be included within the VFD enclosure. VFD shall be housed in a NEMA 1 enclosure.
   2. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for fan control and to eliminate the need for motor de-rating.
   3. With the motor’s rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor.
   4. VFD shall include a “signal loss detection” circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.

2.3 PERFORMANCE, CHIMNEY AUTOMATION SYSTEM

A. The Chimney Automation System will ensure that the draft set-point (in. W.C.) is reached and maintained within 30 seconds of burner light-off. This can be measured with an external manometer at the appliance outlet.

B. Ramp-up and ramp-down time of the fan will be no more than 20 seconds.

C. The Chimney Automation System will maintain the draft at the appliance outlets to within +/- 0.01" W.C. of the draft set-point (in. W.C.) at the appliance outlets as measured with an external manometer.

D. The control will shut down the appliance(s) within 15 seconds if draft is not maintained as stated above.

2.4 STACK CONNECTION

A. Furnish a stainless steel (Model SCA) adapter plate to facilitate mounting the termination fan to the flue material.

2.5 ELECTRICAL REQUIREMENTS

A. Power supply shall be:
   1. To the EBC31 control: 1x120V AC, 60 Hz.
   2. To the variable frequency drive: As shown on schedule.

B. All wiring shall be in accordance with the National Electrical Code.

PART 3 EXECUTION

3.1 INSTALLATION

A. Complete structural, mechanical and electrical connections in accordance with manufacturers' printed instructions.

B. Installing contractor shall install all Chimney Automation System components as indicated on drawings, including low voltage wiring from XTP-Sensor to EBC 31, control, low voltage wiring from EBC 31 to VFDs, line voltage wiring to boiler panels, and power wiring from VFD's to fan motors.
   1. Allow satisfactory arrangement in the space available.
   2. Verify fan operating voltage is the equivalent to the supply voltage AND rated voltage of the VFD.

C. Connecting to the Stack: Install per plans in accordance with manufacturer's printed instructions.

3.2 OPERATING TESTS, START-UP AND ON-SITE SERVICES

A. System vendor's service organization shall employ senior service technicians having experience in all aspects of troubleshooting, corrective service and preventative maintenance and O&M reporting.

B. After installation is completed:
   1. Test the operation of the chimney automation system and:
      a. Increase and decrease draft setting to verify the mechanical draft system reacts as specified.
      b. Increase and decrease firing rate to verify the mechanical draft system reacts as specified.
      c. Verify that the ramp-up time during start up does not exceed 20 seconds. This is defined as the time from the burner is released until the draft settles at the specified draft value.
      d. Use an external manometer (draft gauge) to verify that the draft does not drift more than +/- 0.01" W.C. during a stable load.
   2. Test safety control by firing boiler and:
      a. Shut off the power venter.
      b. Shut off the control.
   3. Submit a written report signed by the manufacturer's authorized representative, confirming that safety and operating controls have been properly installed.

3.3 OPERATING INSTRUCTIONS

A. Instruct the Owner's Representative and designated personnel in the proper operation and maintenance of the packaged system.

END OF SECTION

SECTION 235216
CONDENSING BOILERS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, water-tube condensing boilers, trim, and accessories for generating hot water.

B. Related Sections
   1. Section 235100 BREECHINGS, CHIMNEYS AND STACKS.
   2. See Commissioning Requirements Section 019113.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 ACTION SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
   1. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
      a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
      b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
   2. Wiring Diagrams: Power, signal, and control wiring.

C. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Section 230548 "VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

E. Other Informational Submittals:

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Condensing Boilers: 20 years from date of ~~Substantial~~ FInal Completion. **ADD-3**

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Raypak.
2. Or equal.

2.2 CONDENSING BOILERS

A. SCAQMD Certified at less than 20 ppm.

B. Description: Factory-fabricated, -assembled, and -tested, condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

C. Heat Exchanger: Finned-cupro nickel primary and stainless-steel secondary heat exchangers.

D. Combustion Chamber: Stainless steel, sealed.

E. Burner: Natural gas, forced draft drawing from gas premixing valve.

F. Blower: Centrifugal fan to operate during each burner firing sequence and to pre-purge and postpurge the combustion chamber.

1. Motors: Comply with requirements specified in Section 230513 "COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT."
   a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

G. Gas Train: Combination gas valve with manual shutoff and pressure regulator.

H. Ignition: Silicone carbide hot-surface ignition that includes flame safety supervision and 100 percent main-valve shutoff. 3-try type.

I. Integral Circulator: Cast-iron body and stainless-steel impeller sized for minimum flow required in heat exchanger.

J. Casing
   1. Jacket: Sheet metal, with snap-in or interlocking closures.
   2. Control Compartment Enclosures: NEMA 250, Type 1A.
   3. Finish: Textured epoxy.
   4. Insulation: Minimum 1-inch- thick, mineral-fiber insulation surrounding the heat exchanger.
   5. Combustion-Air Connections: Inlet and vent duct collars.
   6. Mounting base to secure boiler.
      a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" when mounting base is anchored to building structure.

2.3 TRIM

A. Include devices sized to comply with ANSI B31.9, "Building Services Piping."

B. Aquastat Controllers: Operating, firing rate, and high limit.

C. Safety Relief Valve: ASME rated.

D. Pressure and Temperature Gage: Minimum 3-1/2-inch diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

E. Boiler Air Vent: Automatic.

F. Drain Valve: Minimum NPS 3/4 hose-end gate valve.

G. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

2.4 HOT WATER BOILER TRIM

A. Safety-Relief Valve: ASME rated, factory set to protect boiler and piping as per schedule/drawings. 100 psi maximum allowable working pressure.

B. Gauge: Combination water pressure and temperature shipped factory installed. LCD outlet temperature readout to be an integral part of the front boiler control panel display to allow for consistent easy monitoring of temperatures factory mounted and wired.

C. Standard Trim
   1. Aluminum Condensate Receiver Pan
   2. Low Air Pressure Switch
   3. Blocked Flue Detection Switch
   4. Modulation Control
   5. Temperature/Pressure Gauge
   6. Manual Reset High Limit
   7. Low Gas Pressure Safety Switch
   8. Low Water Cutoff with Manual Reset
   9. Gas Pressure Regulator to provide 4” Incoming Pressure to Main Gas Valve – Shipped Loose for Field Installation.
   10. Air inlet filter
   11. Supply Outlet Temperature Display
   12. Full Digital Text Display for all Boiler Series of Operation and Failures
   13. Variable Frequency Drive and Combustion Air Fan with Safety Interlock
   14. Condensate Drain

15. High Gas Pressure Switch and Valve Proving Switch for IRI Compliant GasTrain.
16. Flow Switch mounted and wired.
17. Isolation Valve wiring with mounted J box in rear of boiler.
18. Pump relay mounted and wired.

2.5 CONTROLS

A. Boiler operating controls shall include the following devices and features:
   1. Control transformer.
   2. Set-Point Adjust: Set points shall be adjustable.
   3. Control of multiple boilers in a master – member configuration.
      a. The master controller shall control the header/loop temperature based upon the system set point.
      b. The master controller shall stage additional boilers off and on as required and control the firing rate for all boilers in the system to optimize system performance.
   4. Sequence of Operations: Refer to section 230900 Sequence of Operations for HVAC Controls

B. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
   1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
   2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
   3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
   4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

C. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
   1. Digital Communication Protocol
      a. Boiler to Boiler: Manufacturer's communication protocol.
      b. Energy Management Control System (EMCS): BACnet.
   2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

2.6 ELECTRICAL POWER

A. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
   1. House in NEMA 250, Type 1 enclosure.
   2. Wiring shall be numbered and color-coded to match wiring diagram.
   3. Install factory wiring outside of an enclosure in a meta raceway.
   4. Field power interface shall be to nonfused disconnect switch.
   5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
   6. Provide each motor with overcurrent protection.

2.7 VENTING KITS

A. Kit: Complete system, ASTM A 959, Type 29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.

2.8 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
   1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Equipment Mounting: Install boilers on cast-in-place concrete equipment base(s) using elastomeric pads. Comply with requirements for equipment bases specified in Section 033000 "CAST-IN-PLACE CONCRETE." Comply with requirements for vibration isolation devices specified in Section 230548 "VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT."
   1. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Section 232113 "HYDRONIC PIPING."

E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.

F. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

G. Install piping from safety relief valves to nearest floor drain.

H. Boiler Venting
   1. Install flue venting kit.
   2. Connect full size to boiler connections. Comply with requirements in Section 235100 "BREECHINGS, CHIMNEYS AND STACKS."

I. Ground equipment according to Section 260526 "GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS."

J. Connect wiring according to Section 260519 "LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
   3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
      b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 12 months of date of ~~Substantial~~ Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose. **ADD-3**

E. Performance Tests
   1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
   2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
   3. Perform field performance tests to determine capacity and efficiency of boilers.
      a. Test for full capacity.
      b. Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.
   4. Repeat tests until results comply with requirements indicated.
   5. Provide analysis equipment required to determine performance.
   6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
   7. Notify Architect in advance of test dates.
   8. Document test results in a report and submit to Architect.

3.5 DEMONSTRATION

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

END OF SECTION

SECTION 237315
CUSTOM CENTRAL STATION AIR HANDLING UNITS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Variable-air-volume air-handling unit.

B. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

C. Related Sections
   1. Section 019113 – Commissioning Requirements

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 150 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.

C. Seismic Performance: Air-handling unit shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.3 ACTION SUBMITTALS

A. Product Data: For each air-handling unit indicated.
   1. Unit dimensions and weight.
   2. Cabinet material, metal thickness, finishes, insulation, and accessories.
   3. Fans
      a. AMCA certified fan-performance curves with system operating conditions indicated.
      b. AMCA certified fan-sound power ratings.
      c. Fan construction and accessories.
      d. Motor ratings, electrical characteristics, and motor accessories.
   4. AHRI certified coil-performance ratings with system operating conditions indicated.
   5. Dampers, including housings, linkages, and operators.
   6. Filters with performance characteristics.
   7. Access door detail drawing.
   8. Acoustical performance data including, inlet, outlet and casing radiated sound power levels.

B. LEED Submittal
   1. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Furnish submittals as required in Section 018113-1.4 for all relevant materials in this section.

C. Delegated-Design Submittal: For vibration isolation and seismic restraints 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
   2. Support location, type, and weight.
   3. Field measurements.

B. Seismic Qualification Certificates: For air-handling units, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Filters: One set for each air-handling unit.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain packaged custom outdoor air-handling units through one source from a single manufacturer.

B. Conform to all information documented in approved submittal package and construction notes.

C. Specified air handling units shall be factory tested as completed assemblies for vibration, sound and performance.

D. All air handling units shall be ETL listed and labeled, as completed assemblies, certifying compliance with UL 1995.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged custom indoor and outdoor air handling units and are based on the specific system indicated. Refer to Section 016000 – Product Requirements.

F. 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.

G. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

H. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

I. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

J. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

K. Title 24, Part 6 of the California Code of Regulation Compliance (California Energy Code).

L. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

C. Coordinate penetrations required in the unit casing for control devices and wiring.

1.9 WARRANTY

A. Manufacturer agrees to repair or replace device/component that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of ~~Substantial~~ Final completion. **ADD-3**

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following manufacturers. The contractor shall bare all costs for architectural, mechanical, structural, acoustical, seismic, electrical changes required to match the performance, fit and characteristics of the base bid equipment:

1. Energy Labs.
2. Trane.
3. Carrier.
4. Or equal.

2.2 MANUFACTURED UNITS

A. Packaged custom outdoor air-handling units shall be factory assembled and tested and consist of direct drive plenum centrifugal supply and return fans, cooling and heating coils, plenums, final filters, condensate drain pans, UV light, mixing dampers, control devices and accessories.

2.3 UNIT CASINGS

A. Materials: Formed and reinforced double wall insulated panels, fabricated to allow removal for access to internal parts and components with joints between sections sealed. Unit shall be built for outdoor installation.

B. Outside casing: Galvanized steel, 16 gauge, utilize a standing seam modular panel type construction. The panels shall be caulked and attached to each other, to the roof, and to the floor using nuts and bolts. Drive screw attachment is not acceptable. All panels shall be removable. All seams shall be sealed with an acrylic latex sealant prior to assembling the panels and after completion of the assembly. All floor openings shall have 12 gauge galvanized steel framed flange around the entire perimeter of opening for duct connection. Minimum sound transmission loss (STL) through the unit panels shall be as follows:

2 INCHES – 3 PCF INSULATION					
125	**250**	**500**	**1K**	**2K**	**4K**
25	**29**	**36**	**42**	**47**	**48**

1. Paint finish: After final assembly, the unit exterior shall be coated with an industrial grade, self-priming semi-gloss high solids 2K polyurethane gray 219GY1 finish. In addition, all fan bases, springs, and structural steel supports shall be coated with the same finish. The paint system shall meet ASTM B117 salt spray test for minimum of 2,000 hours.
2. Outdoor units shall have roofs with a minimum of 1/4-inch per foot slope to insure no standing water.
3. Inside casing: 316 stainless steel solid liner, for sections upstream and downstream of cooling coil, 20 gauge galvanized steel solid liner for remainder except use 20 gauge perforated liner in the fan sections and return air inlet plenum.
4. Floor plate: 14 gauge galvanized steel.
5. Unit base: Each unit shall be constructed on a minimum 6-inch high base fabricated from ASTM A36 welded structural steel channel. Tubular or formed metal channel bases are not acceptable. Channel bases shall be sized as a function of air handling lengths as follows:

AHU Length in Feet	**Minimum Channel Size**
Up to 30	8” x 2-1/2” (11.5 lbs/linear ft.)
31 to 40	10” x 2-3/4” (15.3 lbs/linear ft.)
41 to 50	12” x 3” (20.7 lbs/linear ft.)

   a. Heavy removable lifting lugs shall be added to the perimeter channel along the longest length of the unit. The unit floor shall be fabricated of 0.125-inch thick, #3003 aluminum tread plate sheets. The floor shall be supported by structural and minimum 12 gauge formed galvanized steel members. Max spacing of floor support shall be 24-inch centers. These formed members shall be welded to other members for maximum strength. Floor skin shall be supplied with standing seams design and drive cleats to maintain water and airtight seal. The flooring shall be spot welded to the members below. No penetrations thru the floor skin shall be acceptable. Welds shall be below the floor and spaced no greater than 6 inches on center.
   b. Fans, coils and major components shall be supported with structural steel members directly below these items.

C. Casing Insulation and Adhesive
1. Materials: ASTM C 1071, Type II, with neoprene coated surface to cover all walls and ceiling surfaces exposed to air stream to prevent erosion of glass fibers. There shall be no raw edges of insulation exposed to the air stream.
2. Thickness: 2 inches, 3 lbs per cubic feet density.
3. Thermal conductivity (k-value): 0.26 at 75 degrees F mean temperature.
4. Fire Hazard Classification: Maximum flame spread to meet NFPA 90A smoke and flame spread requirements.
5. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and ASTM C916.
6. Mechanical fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
7. Location and application: Encased between outside and inside casing.
8. All floors shall be insulated from below using minimum 2-inches thick foam to insure that the entire under surface of the floor is insulated. Liner shall be 20 gauge G90 solid galvanized steel.

D. Inspection and Access Panels and Access Doors

1. Panel and Door Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels
    a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
    b. Gasket: Closed cell hollow round gasketing, applied around entire perimeters of panel frames with a metal encapsulated reinforced backing mechanically fastened to the door frame.
    c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
3. Access Doors
    a. All access doors shall be of thermal break construction, hinged, double wall, insulated, man size access doors shall be provided in all sections requiring access for maintenance or service. Operable door latches shall be provided on either side of the door.
    b. Frame: Extruded aluminum, fully welded at the corners with an anodized finish.
    c. Hardware: Shall be non-corrosive and all hinges and latches shall be adjustable with nuts and bolts.
    d. Maximum leakage: Less than 25 CFM @ 6 inches wg static pressure.
    e. Hinges: Door hinges and latches shall be easily adjustable, without the use of shims or special tools, to allow for a tight seal between the door and the doorframe as the gasketing material compresses over time. The door hinge design shall allow for field reversing of door swing and doors shall be easily removable.
    f. Doors entering into any section of the air handler that contains rotating fans shall be provided with a door interlock safety switch to de-energize the fan motor upon opening.
    g. Gasket: Dual gasket seal system, applied around entire perimeters of panel frames.
    h. Provide minimum 8 inch x 12 inch or 12 inch round windows in fan section doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.
    i. Size: At least 24 inches wide by full height of unit casing up to a maximum height of 72 inches.
4. Locations and Applications
    a. Fan Section: Doors.
    b. Access Section: Doors.
    c. Coil Section: Doors.
    d. Damper Section: Doors.
    e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
    f. Mixing Section: Doors.
5. Service Light: 100-W fluorescent vaporproof fixture and switched junction box located outside adjacent to door.
    a. Locations: Each section accessed with door.
    b. Switch location: Outside supply fan section with 60 minute timer.

E. Controls Openings
1. Provide factory panel and penetrations for controls devices and wiring. Field penetrations of the unit casing are not permitted. Controls cabinet size shall be coordinated with controls manufacturer prior to installation at factory.

F. Condensate Drain Pans
1. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and to direct water toward drain connection.
    a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2007.
    b. Depth: A minimum of 2 inches deep.
2. Integral part of floor plating.
3. Double-wall, (16 gage) 316 stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan at the side of the unit.

5. Units with multiple stacked coils and single coils greater than 48 inches shall have an intermediate drain pan to collect condensate from top coil. The pans shall be min. 0.064 inch (16 gage) 316 stainless steel and drain to the main drain pan through copper downspouts.
6. Drain pan shall be insulated with 2 inches of 1.5 lbm/cu.ft. density insulation to prevent condensation under the drain pan. Insulation shall be protected with an 0.064 inch (16 gage) galvanized steel liner.
7. Drain pans shall be sized such that the entire coil, including headers and return bends are inside the drain pan.

G. Air-Handling-Unit Mounting Frame: ASTM A36 welded structural steel channel or tubular base designed for low deflection, with removable lifting lugs.
1. Steel bases shall be sized as a function of the air handling length.
2. Units less than or equal to 20 feet in length shall have a minimum 4 inch channel and units greater than 20 feet in length shall have a minimum 6 inch channel.
3. Deflection of the frame members shall be limited to L/200.
4. Intermediate tubular steel cross members shall be fully welded and located at lighting points and as need to support internal components such as coils and fans.
5. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment when air-handling unit frame is anchored to building structure.

2.4 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.
a. Turned, ground, and polished hot-rolled ASI C-1018, 1040 or 1045 steel with keyway. Ship with a protective coating of lubricating oil.
b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
c. Fan selection shall meet scheduled minimum efficiencies.
d. Motor brake horsepower shall meet the scheduled maximum values.

B. Fan Base: The fan and motor shall be mounted on an all welded, structural steel, prime coated, internal isolation base with springs selected to provide 99 percent isolation efficiency from the building structure. The internally mounted motor shall be provided on a slide rail base to allow proper adjustment of belt tension.

C. Sound Performance: All fans shall be AMCA certified. Non-certified AMCA fan data is not acceptable.

D. Plenum fans shall be configured so that both fan bearings are on the drive side of the wheel with the wheel over hung (Arrangement #4 for all direct drive fans).
1. Supply fan shall be direct drive Arrangement #4 whenever possible.
2. There shall be no obstructions (i.e., bearings or bearing supports, etc.,) at the inlet of the fan. Fan wheel shall be aluminum with aluminum extruded airfoil blades.

E. Airfoil, Centrifugal Fan Wheels: Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

F. All fans shall be provided with spring-style thrust restraints.

G. Fan Shaft Bearings
1. Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
2. All fan bearings shall be selected for a minimum service life of ASTM L-10 200,000 hours.
3. Fan bearings shall be mounted on a structural steel channel or machined surface.

H. Internal Vibration Isolation and Seismic Control: Fans shall be factory mounted with manufacturer's standard restrained vibration isolation mounting devices. Refer to Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT, for requirements.
   1. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT when fan-mounting frame and air-handling-unit mounting frame are anchored to building structure.

I. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.
   1. Enclosure Type: Totally enclosed, fan cooled.
   2. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
   3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
   5. The motor shall be mounted on an adjustable slide rail motor base with two adjusting bolts per side.
   6. Mount unit-mounted disconnect switches on exterior of unit.
   7. Motors shall be mounted and isolated on the same integral base as the fan

2.5 COIL SECTION

A. General requirements for coil section.
   1. Continuous circuit coil fabricated according to ARI 410.
      a. Threaded piping connections on same end.
      b. Tubes: 0.20” copper, with individually replaceable copper return bends of 0.025” wall thickness on both sides of the coil. Coils incorporating a hairpin type design are not acceptable.
      c. Fins: 0.008” aluminum with fin spacing not closer than 12 fins per inch.
      d. Fin and Tube Joint: Mechanical bond.
      e. Headers shall be non-ferrous seamless copper, outside the air stream but inside the cabinet casing and provided with brazed copper male pipe connections that extend through the air handler casing. Drain and vent tubes shall be extended to the exterior of the air handling unit.
      f. Blank-offs: All sides of coils shall be carefully blanked off with the same materials used for the coil casings, to ensure all air passes through the coil.
      g. Casings: Casings shall be minimum 16 gauge, 316 stainless steel with double formed 1-1/4 inch stacking flanges and 3/4 inch flanges on the side plates. All other coil casing shall be of 16-gauge galvanized steel. Reinforcing shall be furnished so that the unsupported length is not over 60 inches.
      h. Intermediate drain pans are to be furnished on multiple coil units and single coils greater than 48 inches high. The pans shall be 16 gauge 316 stainless steel and drain to the main drain pan through copper downspouts.
   2. All coils shall have counter flow construction with connections left or right hand as shown on the drawings. The use of internal restrictive devices to obtain turbulent flow will not be accepted.
   3. Coils shall not act as structural component of unit.
   4. Coil headers shall be located inside of the cabinet casing with only the pipe connections extending through the casing.
   5. Tubes shall be expanded into the fin collars to provide a permanent mechanical bond.
   6. Flanged tube sheets shall have extruded tube holes to prevent raw edges of tube sheets cut into copper tubes because of thermal expansion of tubes in tube holes. Tube holes with raw sheet metal edges are not acceptable.
   7. All coil assemblies shall be tested under water at 300 psi.
   8. Coil face velocities shall be sized according to schedule.

9. Coils shall be fully enclosed within the casing mounted angle racks manufactured to allow coils to slide out individually.
10. Seismic Fabrication Requirements: Fabricate coil section, internal mounting frame and attachment to coils, and other coil section components with reinforcement strong enough to withstand seismic forces defined in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT, when coil-mounting frame and air-handling-unit mounting frame are anchored to building structure.

2.6 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section
   1. Comply with NFPA 90A.
   2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
   3. Filter sections shall be fabricated as part of the air-handling unit. Filters shall be arranged for upstream, downstream, or side loading as shown on the drawings. Provide filter holding frames to accommodate scheduled filters.
   4. Frame: 0.064 inch (16 gage) galvanized steel, and shall be fully welded to reduce leakage of air through corners.

B. Mini-Pleat Box Filters
   1. Factory-fabricated, dry, packaged air filters, extended-surface type.
   2. Thickness: 12 inches.
   3. Initial Resistance: shall not exceed 0.30” at 500 fpm when clean.
   4. Recommended Final Resistance: 1 inch wg.
   5. Arrestance (ASHRAE 52.1): 90.
   6. MERV (ASHRAE 52.2): 13.
   7. Media: Fibrous material formed into deep-V-shaped mini-pleats with antimicrobial agent and held by self-supporting wire grid.
   8. Mounting Frames: Welded, galvanized steel, with gaskets and fasteners, suitable for bolting together into built-up filter banks.

C. Filter Gage
   1. 3-1/2-inch diameter, diaphragm-actuated dial with signal flag in metal case.
   2. Vent valves.
   3. Black figures on white background.
   4. Front recalibration adjustment.
   5. 2 percent of full-scale accuracy.
   6. Range: 0- to 2.0-inch wg.
   7. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch tubing, and 2- or 3-way vent valves.

2.7 DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg pressure differential.

B. Dampers shall be sized for a maximum face velocity of 1200 fpm based upon gross damper area. Furnish full height 24 inches wide access doors for damper and linkage service.

C. Dampers shall be supplied with low leak extruded aluminum airfoil blades. Blades shall be supplied with rubber edge seals and stainless steel arc end seals. Rubber edge seals shall be backed by the damper blade to assure a positive seal in the closed position. Dampers shall be provided with nylon bearings within extruded openings. Damper leakage shall not exceed 6 cfm/sq.ft. at 5 inch w.g. of static pressure. Leakage testing shall be in accordance with AMCA standard 500 figure 5.5. Test results must be from independent testing laboratory.

2.8 LOUVERS

A. Provide louvers for outside air and exhaust air.

B. Outside air louvers shall be sized for a maximum velocity of 500 fpm and exhaust air louvers shall be sized for a maximum face velocity of 800 fpm based on gross louver area.

C. Louvers shall have zero water penetration at 600 fpm air velocity.

D. Provide test results from independent testing laboratory. Test must be conducted in accordance to AMCA Standard 500 Figure 5.5.

E. Louver water carry over must be less than 0.01 oz/sq.ft. at 1,100 fpm of free louver area. Test must be conducted by an independent testing laboratory per AMCA 500-89, Figure 5.6.

F. Hoods in lieu of louvers are not acceptable.

2.9 CONTROLS REQUIREMENTS

A. Required air handling unit mounted control enclosures, controllers, control devices and wiring shall be mounted in the factory. Field mounted enclosures, penetrations and conduit and/or wiring is not permitted.

B. The manufacturer shall provide NEMA 3R steel enclosure painted to match the unit casing attached to these conduits for the controls contractor to install their control panel in the field. Size of the enclosure shall be coordinated with controls manufacturer.

C. Refer to the following sections for additional requirements:
   1. 230913, “BUILDING AUTOMATION SYSTEM FOR HVAC.”
   2. 230923, “INSTRUMENTATION AND CONTROL DEVICES FOR HVAC.”

D. Provide an airflow monitoring station for each fan. Airflow monitoring station shall display a reading as well as allow an analog output to the EMCS. Multiple fans on a common bank shall have individual sensors per fan with a common transmitter indicating total airflow.
   1. Manufacturer shall be Ebtron, Fan Inlet Hybrid Series or equal.
   2. Fan shall have a sensor face mounted at the inlet cone without affecting fan performance or sound. Each sensor node shall contain two individually wired, hermetically sealed bead-in-glass thermistors. Airflow accuracy shall be +/- 2% of reading over the entire operating airflow range of not less than 0 to 10,000 cfm.
   3. The transmitter shall have an integral, minimum 16 character LCD display shall also be capable of displaying individual airflow and temperature readings of each independent sensor node.
   4. Output signal 4-20 mA. DC or 0-5 VDC standard.
   5. The transmitter shall be housed in a NEMA 3R enclosure with external signal tubing, power and output signal connections.

E. Provide an airflow monitoring station for outside airflow monitoring. Airflow monitoring station shall display a reading as well as allow an analog output to the EMCS.
   1. Manufacturer shall be Ebtron, or equal.
   2. Sensor node shall contain two individually wired, hermetically sealed bead-in-glass thermistors. Airflow accuracy shall be +/- 2% of reading over the entire operating airflow range of not less than 0 to 40,000 cfm.
   3. The transmitter shall have an integral, minimum 16 character LCD display shall also be capable of displaying individual airflow and temperature readings of each independent sensor node.
   4. Output signal 4-20 mA. DC or 0-5 VDC standard.
   5. The transmitter shall be housed in a NEMA 3R enclosure with external signal tubing, power and output signal connections.

2.10 VARIABLE FREQUENCY DRIVES

A. General: Furnish complete individual variable frequency VFDs for each fan designated on the drawing schedules to be variable speed with requirements in Section 262923 VARIABLE FREQUENCY MOTOR CONTROLLERS.

2.11 ELECTRICAL REQUIREMENTS

A. All air handling unit and electrical panel wiring shall be performed in a UL 508 listed shop.

B. Provide single source power panels (SSPP's) that are constructed according to NEC regulations and carry a UL 508 listing and label.
   1. The panel shall include a non-fused main disconnect switch covering all fans in each unit, VFDs for variable volume units, and any necessary transformers, Hand–Off–Auto switches, relays and pilot lights for complete operation of the fans in the unit.
   2. The single source power panels shall be factory wired to all factory furnished devices such as motors and interlocks.

C. The air handling unit manufacturer, for the purpose of sole source responsibility, shall manufacture all electrical panel assemblies supplied for the air handlers. The air handling unit manufacturer shall be a UL 508 listed panel shop.

D. The main control panel shall have access door(s) for direct access to the controls. The panel shall be NEMA Type 3R and shall contain a single externally operated, non-fused disconnect, suitable for copper wire up to and including 3-inch conduit.

E. All wiring shall be run in EMT conduit, (or flexible when connecting to a motor), raceways are not acceptable.

F. Where unit requires splits, junction boxes shall be furnished on each section to allow the electrical contractor to make final connections in the field. Wiring shall be clearly labeled to allow ease in final interconnections.

2.12 ULTRAVIOLET (UV) GERMICIDAL LAMPS

A. A heavy duty UVC germicidal irradiation system using short wave UVC germicidal lamps shall be furnished as described herein.

B. The air-handling unit manufacturer shall furnish and install, including interconnecting wiring and safety interlocks, a germicidal UVC irradiation system.

C. Intensity
   1. The minimal UV energy striking a targeted surface shall be sufficient to destroy a monolayer of common mold and fungi within 6 hours.
   2. Lamps and fixtures are to be installed in sufficient quantity in such a manner to insure equal distribution of UV energy across the cooling face and drain pans.

D. Testing and Safety Listing
   1. UV fixtures shall have been tested and listed as UL/C-UL under category code ABQK (Accessories, Air Duct Mounted), UL Standards 153, 1598 and 1995 respectively, no exceptions.
   2. Manufacturer of UVC components shall be ISO 9001 certified.

E. Installation by Air Handling Unit Manufacturer
   1. Air handling unit factory authorized and trained service technicians shall install the tubes in the air handling units after the units have been installed.
   2. UV light manufacturer is to certify installation has been such that UV reflective and shadowed energy losses are the lowest possible.
   3. Cumulative sum length of UV fixtures end-to-end shall equal the coil width plus or minus 3 inches.
   4. System shall be installed a minimum of 9 inches and maximum of 20 inches from coil surface (based on manufacturer's calculations and recommendations).
   5. One row of lamps shall serve not more than 48 inches of coil height.
   6. Installation shall be installed on tracks allowing the UV fixture to slide into place. Tracks shall be designed in such a manner the UV fixture can be easily removed and maintained or replaced. Multiple UV assemblies shall connect via interlock.
   7. Fixture rows shall be terminated (for safety) to factory supplied hard-wired module.
   8. Light rows shall be mounted so UVC covers the entire coil face and drain pan surfaces as well as line of sight air stream.
   9. Air handling unit manufacturer installation shall include all mechanical interlock and wiring to assure UV light assembly is not energized when any access door is opened.

10. For future reference, the air handling unit manufacturer shall include detailed and certified drawings locating the fixtures. Drawings shall also be included in all operation and maintenance manuals.

F. Lamps
   1. Each lamp shall contain no more than 8 milligrams of mercury consistent with current environmental practices and shall be capable of producing its specified output in temperature of 55-135 deg F and airflow velocities up to 1,000 fpm.
   2. Useful lamp life shall be 9,000 hours with no more than 20 percent output loss at the end of one year continuous use.
   3. Lamps shall be constructed of UV proof metal bases and shall not produce ozone or other secondary containment.

G. Fixtures
   1. Each fixture shall be constructed of stainless steel. Galvanized steel or aluminum is not acceptable. All integral parts of the fixture shall be self-contained.
   2. Fixtures constructed to UL drip proof design and equipped with safety approved fixture-to-fixture plugs to facilitate UL approved multiple fixture and row coupling to A/C power.
   3. The UV assembly shall include mechanical interlocks to prevent energizing unless the system is properly installed.

H. Power Supplies
   1. The power supply shall be electronic, high efficiency type capable of producing the required coverage at no more than 80 watts of power consumption for each for square feet of cross sectional plenum area. Power supply shall be 120 VAC, 60 hertz.
   2. Power supply shall be matched to the lamp and designed to maximize photon production, radiance and reliability.
   3. Electronic power supply shall be UL listed for application in airstreams between 55-135 deg F.

I. Portal: The UV lamp plenum area shall be equipped with a portal for viewing the lamp assembly. Portal shall be constructed to allow viewing without the possibility of exceeding the minimal erythemal dose.

J. Provide exterior switch to control UV lights and interlink with section door to turn off lights whenever door is open.

2.13 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Unit Sound Power Levels
   1. Factory Testing Requirements
      a. Perform factory sound tests for all air handling units. All costs associated with remedial measures to comply with the specifications shall be borne by the air handling unit manufacturer:
      b. Tests shall be carried out in accordance with AMCA Standard 300-96 Reverberant Room Method for sound testing of fans, and AMCA Standard 210, Laboratory Methods of Testing Fans for rating.
      c. All testing shall be conducted in a laboratory AMCA certified for both sound and performance.
      d. Sound power data shall be given at the supply connection(s) (outlet), return connection(s) (inlet), outside air connection(s) (inlet) and exhaust connection(s) (outlet) in addition to radiated sound power from the cabinet.
         1) Raw fan sound power data shall be derived from tests done in accordance with AMCA Standard 300-96.
         2) Data extrapolated from non-like fan sizes and types scheduled are not acceptable.

3) Attenuation assumed for the cabinet configuration, type of insulation, opening locations and sizes, etc., shall be verified through actual test measurements.
4) The Owner's Representative may, at his option, request copies of such tests.

2. The air-handling unit equipment manufacturer shall furnish calculations showing the estimated sound power levels for each supply air, return air, exhaust air and outside air opening and unit casing radiation for each air-handling unit.
3. Applicable Standards: All sound power level measurements shall be made in complete accordance with the latest version of ARI Standard 260, Sound Rating of Ducted Air Moving and Conditioning Equipment or a test method approved by the acoustical consultant. All testing shall be conducted in an AMCA certified testing laboratory. Equivalent test procedures may be substituted for the above procedures if approved in advance by the Owner's Representative.
4. The sound power level of the air-handling unit's supply air, return air, exhaust air and outside air openings and case-radiated noise shall not exceed the values list in the Air-Handling Unit Schedule below when operating at the maximum design airflow and static pressure conditions.

D. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install air-handling units on concrete bases. Secure units to anchor bolts installed in concrete bases. Comply with requirements for concrete bases specified in Section 033000 – CAST IN PLACE CONCRETE."

1. Install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance. Chilled water pipe connection to cooling coils and heating hot water pipe connections to heating coil shall be offset from the coil and shall not interfere with coil pull space or access doors into the air handling unit. Contractor shall coordinate exact location with air-handling unit manufacturer.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor sink. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Chilled-Water and Heating Hot Water Piping: Comply with applicable requirements in Section 232113 – HYDRONIC PIPING. Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 – AIR DUCT ACCESSORIES.

G. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

H. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

I. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including piping and electrical connections. Report results in writing.
   1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
   2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to provide start-up assistance

B. Final checks before start-up: Perform the following:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
   3. Perform cleaning and adjusting specified in this section.
   4. Disconnect fan drive from motor. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
   5. Verify that zone dampers are in full open position for each zone.
   6. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
   7. Verify that face-and-bypass dampers provide full face flow.
   8. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
   9. Comb coil fins for parallel orientation.
   10. Install new, clean filters.
   11. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

C. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC for air handling system testing, adjusting, and balancing.

3.7 CLEANING

A. Clean packaged custom outdoor air handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting and balancing packaged custom air-handling and air-distribution systems, clean filter housings and install new filters.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain air-handling units. Refer to Section 017900 – DEMONSTRATION AND TRAINING.

END OF SECTION

SECTION 237413
PACKAGED DIRECT EXPANSION AIR HANDLING UNITS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
   1. Direct-expansion cooling.
   2. Heat-pump refrigeration components.
   3. Gas furnace.
   4. Integral, space temperature controls.
   5. Roof curbs.

B. Related Sections include the following:
   1. See Commissioning Requirements Section 019113.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor Air Refrigerant Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air conditioning, heating, or ventilating apparatus.

G. Supply Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air conditioning, heating, or ventilating apparatus.

H. VVT: Variable-air volume and temperature.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design RTU supports to comply with wind and seismic performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Wind-Restraint Performance
   1. Basic Wind Speed: 110 mph.
   2. Building Classification Category: III.

3. Minimum 10 lb/sq. ft multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

C. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. LEED Submittals

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 – "Systems and Equipment."

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

D. Delegated-Design Submittal: For RTU supports 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. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind- and Seismic-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

E. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Furnish submittals as required in Section 018113-1.4 for all relevant materials in this section.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs will be attached.
2. Roof openings
3. Roof curbs and flashing.

B. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

1.8 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 – "Systems and Equipment" and Section 7 – "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 – "Heating, Ventilating, and Air Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Gas-fired heating rooftop units shall conform to ANSI Z21.47 for construction of packaged air conditioner.

H. Gas-fired heating rooftop units shall conform to UL 795 for construction of packaged air conditioner.

I. Title 24, Part 6 of the California Code of Regulation Compliance.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of ~~Substantial~~ Final Completion. **ADD-3**
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of ~~Substantial~~ Final Completion. **ADD-3**
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of ~~Substantial~~ Final Completion. **ADD-3**
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of ~~Substantial~~ Final Completion. **ADD-3**

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Trane; American Standard Companies, Inc.
2. AAON, Inc.
3. Carrier Corporation.
4. YORK International Corporation.
5. Or equal.

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Exterior Casing Thickness: min. 0.052 inch thick.

C. Inner Casing Fabrication Requirements

1. Inside Casing: Galvanized steel, min. 0.034-inch thick, perforated 40 percent free area.

D. Access doors shall be provided with door handles that can be operated manually by hand without use of tools.

E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1/2-inch.
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

F. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1.

1. Double Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple both sides of drain pan.

G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 FANS

A. Direct Driven Supply Air Fans: plenum fan; with permanently lubricated, ECM motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Condenser Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

C. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT when fan mounted frame and RTU mounted frame are anchored to building structure.

D. Bearings shall be selected for a minimum L10 life in excess of 200,000 hours at maximum catalogued operating speed.

E. Fan Motor: Comply with requirements in Section 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.

2.4 COILS

A. Supply-Air Refrigerant Coil
   1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
   2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
   3. Coil Split: Interlaced.
   4. Baked phenolic coating.
   5. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.

B. Outdoor-Air Refrigerant Coil
   1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
   2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
   3. Baked phenolic coating.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties
   1. Refrigerant: R-407C or R-410A.
   2. Expansion valve with replaceable thermostatic element.
   3. Refrigerant filter / dryer.
   4. Manual reset high-pressure safety switch.
   5. Automatic reset low-pressure safety switch.
   6. Minimum off-time relay.
   7. Automatic reset compressor motor thermal overload.
   8. Brass service valves installed in compressor suction and liquid lines.
   9. Low ambient kit high-pressure sensor.
   10. Hot gas reheat solenoid valve with a replaceable magnetic coil.
   11. Hot gas bypass solenoid valve with a replaceable magnetic coil.
   12. Four way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
   1. Pleated: Minimum 85 percent arrestance when tested in accordance with ASHRAE 52.1, and MERV 13 category 52.2 ASHRAE test standard.

2.7 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
   1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.
   1. Fuel: Natural gas.
   2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension.

E. Safety Controls
   1. Gas Control Valve: Modulating.
   2. Gas Train: Single-body, regulated, redundant, 24 V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 DAMPERS

A. Outdoor and Return Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
   1. Damper Motor: Modulating with adjustable minimum position.
   2. Relief Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230900 – INSTRUMENTATION AND CONTROL FOR HVAC.

B. Basic Unit Controls
   1. Control voltage transformer.
   2. Wall-mounted thermostat or sensor with the following features:
      a. Heat-cool-off switch.
      b. Fan on-auto switch.
      c. Fan-speed switch.
      d. Automatic changeover.
      e. Adjustable deadband.
      f. Exposed set point.
      g. Exposed indication.
      h. Degree F indication.
      i. Unoccupied-period-override push button.
      j. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.
   3. Wall-mounted humidistat or sensor with the following features:
      a. Exposed set point.
      b. Exposed indication.
   4. Unit-Mounted Annunciator Panel for Each Unit
      a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
      b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
      c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

C. DDC Controller
   1. Controller shall have volatile-memory backup.
   2. Safety Control Operation
      a. Firestats: Stop fan and close outdoor-air damper if air greater than 120 degrees F enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
      b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 283111 – DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM.
      c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 degrees F.
      d. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
   3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of four programmable periods per day.
   4. Unoccupied Period:
      a. Override Operation: Two hours.

5. Supply Fan Operation
   a. Occupied Periods: Run fan continuously.
   b. Unoccupied Periods: Cycle fan to maintain setback temperature.
6. Gas Furnace Operation
   a. Occupied Periods: Modulate burner to maintain discharge temperature.
   b. Unoccupied Periods: Cycle burner to maintain setback temperature.
7. Fixed Minimum Outdoor-Air Damper Operation
   a. Occupied Periods: Open to minimum outdoor air position based upon scheduled airflow and field verification.
   b. Unoccupied Periods: Close the outdoor-air damper.

D. Interface Requirements for HVAC Instrumentation and Control System
1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide BACnet compatible interface for central HVAC control workstation for the following:
   a. Unit Status Reports
      1) Adjusting setpoints.
         (a) Active cooling/supply air setpoint
         (b) Active heating/supply air setpoint
         (c) Space temperature
      2) Monitoring supply fan start, stop, and operation.
      3) Inquiring data to include outdoor-air damper position, supply- and room-air temperature and humidity.
      4) Monitoring occupied and unoccupied operations.
      5) Operating mode
      6) Active rooftop diagnostics
      7) Active cooling/heating mode
      8) Supply air temperature
      9) Supply fan status
      10) Supply fan percent modulation
      11) Active space pressure
      12) Active supply air pressure
      13) Compressor on/off status
      14) Condenser on/off status
      15) Heat stage on/off status
      16) Hydronic heat output
      17) Monitoring constant and variable motor loads.
      18) Monitoring cooling load.
      19) Outdoor air flow
      20) Monitoring air-distribution static pressure and ventilation air volume.
   b. Individual rooftop diagnostic and alarm statuses shall include the following latching items for each rooftop unit:
      1) Emergency stop
      2) Supply fan failure
      3) Compressor trip (each circuit)
      4) Manual supply air static pressure limit
      5) Compressor contactor fail (each circuit)
   c. Individual rooftop diagnostic and alarm statuses shall include the following non-latching items for each rooftop unit:
      1) Zone temperature sensor failure
      2) Supply air temperature sensor failure
      3) Auxiliary temperature sensor failure
      4) Outdoor air temperature sensor failure
      5) Occupied zone cool/heat setpoint failure
      6) Supply air pressure sensor failure
      7) Outdoor air humidity sensor failure
      8) Evaporator temperature sensor failure (each circuit)
      9) Condenser Temperature sensor failure (each circuit)
      10) Morning warm-up zone sensor fail

11) Heat failure
12) Unoccupied zone cool/heat setpoint failure
13) Supply air pressure setpoint failure
14) Space static pressure setpoint failure
15) Space pressure sensor failure
16) Return air temperature sensor failure
17) Return air humidity sensor failure
18) Auto supply air static pressure limit
19) Unit communications loss
20) Heat communications failure
21) Night setback panel communications failure
22) Ventilation override mode communications loss
23) Supply air temperature cool/heat setpoint fail
24) Dirty filter
25) Night setback zone temperature sensor fail

2.11 ACCESSORIES

A. Duplex, 115 V, ground-fault-interrupter outlet with 15 A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

C. Coil guards of painted, galvanized-steel wire.

D. Hail guards of galvanized steel, painted to match casing.

E. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

2.12 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVACE PIPING AND EQUIPMENT.

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
   1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
      a. Materials: ASTM C 1071, Type I or II.
      b. Thickness: 2 inches.
   2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
      a. Liner Adhesive: Comply with ASTM C 916, Type I.
      b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
      c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
      d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: 14 inches.

D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT, for wind-load requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install RTUs on concrete base. Comply with requirements for vibration isolation devices and seismic restraint specified in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT. Comply with requirements for concrete base specified in Section 033000 – CAST-IN-PLACE CONCRETE.

B. Roof Curb: Install on roof structure or concrete base, level and secure, according to ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 – ROOF ACCESSORIES. Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

D. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

C. Gas Piping: Comply with applicable requirements in Section 231123 – FACILITY NATURAL GAS PIPING. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

D. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 – AIR DUCT ACCESSORIES.
4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks per manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit per manufacturer's written instructions.
    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.
    d. Measure flue-gas temperature at furnace discharge.
    e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 degrees F above return-air temperature:
    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply-air volume.
    b. Outdoor-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
    a. Compressor refrigerant suction and hot-gas pressures.

b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Firestat alarm.
29. After startup and performance testing and prior to ~~Substantial~~ Final Completion, replace existing filters with new filters. **ADD-3**

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Campus maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 – DEMONSTRATION AND TRAINING.

END OF SECTION

SECTION 238126
VARIABLE REFRIGERANT FLOW (VRF) SYSTEMS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This section includes information on the general requirements for work completed under Division 23.

B. Related Sections

1. See Commissioning Requirements Section 019113.

C. This project is required to achieve certification under LEED-NC v 2009. The green building parameters required for this affect all aspects of construction. Materials in this section may be subject to the requirements of IEQc4.1, IEQc4.2 and/or IEQc4.4. Please review the LEED Requirements Section 018113 of this Specifications Manual.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. LEED Submittals

1. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Furnish submittals as required in Section 018113-1.4 for all relevant materials in this section.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

D. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved

1. Ceiling suspension components.
2. Structural members to which fan-coil units will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
6. Perimeter moldings for exposed or partially exposed cabinets.

E. Samples for Initial Selection: For units with factory-applied color finishes.

F. Samples for Verification: For each type of fan-coil unit indicated.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals.

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Owner's Representative, and marked for intended use.
   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
   2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

1.4 COORDINATION

A. Coordinate layout and installation of units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fan Coil Unit Filter: Furnish one spare filters for each filter installed.
   2. Fan Belts: Furnish one spare fan belt for each unit installed.

1.6 WARRANTY

A. Manufacturer agrees to repair or replace equipment/device/component that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years from date of ~~Substantial~~ Final completion. **ADD-3**

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of design manufacturer is Trane or equal.

2.2 WALL MOUNTED FAN COIL

A. Cabinet: Manufacturer standard panels in white color.
   1. Insulation: Foamed Polystyrene/Foamed Polyethylene.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.

C. Fan: Cross Flow.

D. Air Filtration Section:
   1. Resin Net (washable)
      a. Comply with NFPA 90A.
      b. Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
      c. Filter-Holding Frames: Arranged for flat or angular orientation, with access doors. Filters shall be removable from one side.

E. Motors: Comply with requirements in Section 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.

F. Control devices and operational sequences are specified in Section 230923 "INSTRUMENTATION AND CONTROL DEVICES FOR HVAC."
   1. DDC Terminal Controller
      a. Scheduled Operation: Fan cycles to maintain room setback temperature. Provide seven-day clock with a minimum of four programmable periods per day.

G. EMCS Interface Requirements

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation.
3. Provide interface for central EMCS workstation for the following functions:
   a. Adjust setpoints.
   b. Fan-coil-unit start, stop, and operating status.
   c. Data inquiry, including supply- and room-air temperature.

H. Electrical Connection: Factory wire motors and controls for a single electrical connection.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER UNIT, HEAT PUMP

A. General: The outdoor unit is designed specifically for use with Trane components or equal.
1. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator. High/low pressure gas line, liquid and suction lines must be individually insulated between the outdoor and indoor units.
2. The outdoor unit can be wired and piped with outdoor unit access from the left, right, rear or bottom.
3. The connection ratio of indoor units to outdoor unit shall be permitted up to 200 percent.
4. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
5. The unit shall incorporate an auto-charging feature and a refrigerant charge check function.
6. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
7. The following safety devices shall be included on the condensing unit; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
8. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature.
9. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation. Each system shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.
10. The outdoor unit shall be capable of heating operation at 0 degrees F dry bulb ambient temperature without additional low ambient controls.
11. The system shall continue to provide heat to the indoor units in heating operation while in the defrost mode. Reverse cycle (cooling mode) defrost during heating operation shall not be permitted due to the potential reduction in space temperature

B. Unit Cabinet: The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

C. Fan
1. The condensing unit shall consist of one or more propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter.
2. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12-inch WG. A field setting switch to a maximum 0.32-inch WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.
3. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
4. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

D. Condenser Coil
1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.

3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
4. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.
5. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.

E. Compressor

1. The inverter scroll compressors shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency or STD ON/OFF) shall be controlled to eliminate deviation from target value.
2. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
3. The capacity control range shall be as low as 6 percent to 100 percent.
4. Each non-inverter compressor shall also be of the hermetically sealed scroll type.
5. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
6. Oil separators shall be standard with the equipment together with an intelligent oil management system.
7. The compressor shall be spring mounted to avoid the transmission of vibration.

F. Electrical

1. The power supply to the outdoor unit shall be 208 volts, 3 phase, 60 Hertz +/- 10 percent.
2. The control voltage between the indoor and outdoor unit shall be 16 VDC non-shielded, stranded 2 conductor cable.
3. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.
4. The control wiring lengths shall be as shown below.

	Outdoor to Indoor Unit	**Outdoor to Central Controller**	**Indoor Unit to Remote Control**
Control Wiring Length	6,665 feet	3,330 feet	1,665 feet
Wire Type	16 AWG, 2 wire, non-polarity, non-shielded, stranded		

2.4 CONTROLS

A. Centralized Controller shall be provided to allow operation of entire system and individual zones from a central controller and through the web via Ethernet connection.

1. The controller system shall be a neutral color plastic material.
2. The controller shall include a minimum 5.7-inch Liquid Crystal Display (LCD, QVGA 320x240, 4096 colors).

B. Electrical Characteristics

1. Control Wiring Size: The wire shall be a non-shielded, stranded, 2 conductor PVC or vinyl clad cable. 18-gauge copper cabling specified. Application of UV stabilized cable should be standard when exposed to outside elements. Plenum rated where applicable. Maximum wiring length between controller and indoor units: 3,280 feet

2. Power Supply to controller shall be 24V AC (transformer to be field supplied by contractor)

C. Operating Characteristics
1. The Intelligent controller shall be able to control, via a full color LCD touch screen, up to 10 outdoor units and 64 indoor unit groups (maximum 128 Fan Coil Units) with the following functions:
2. ON/OFF selection for each Fan Coil Unit or group.
3. Temperature set point adjustment for each Fan Coil Unit or group.
4. Fan speed adjustment for each Fan Coil Unit or group
5. Heat/cool/automatic changeover mode selection
6. Forced shutdown terminals
7. Priority settings for restriction of local access for start/stop, heat/cool mode and set point adjustment (at local remote controllers if installed)
8. Temperature limitation in both heating and cooling mode
9. Weekly schedule with startup and shut off times, temperature settings and operation modes; 16 operations / each day can be set in one schedule, and 8 different schedules are available. In addition a yearly calendar is also available for holidays or periods of non-use
10. Actual time display and setting
11. Reset ability for malfunction codes and filter maintenance warning
12. Automatic Changeover Routine: Allows 3 methods for changeover of a defined zone (i.e. one fan coil or more) based on averaging, fixed, or operating.
13. Zone Temperature Limit Capability (Occupied and Unoccupied)
14. Heating Optimization Routine. Always overheating fan coils to cycle fan.
15. Maximum 13 months back up power supply to maintain the memory.
16. Web enabled feature shall allow operation of I-Touch controller through the web via Ethernet connection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on 6-inch-thick, reinforced concrete base; 6 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Section 033000 – Cast-in-Place Concrete. Coordinate anchor installation with concrete base.

D. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

E. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

F. Suspend fan-coil units from structure with hangers. Vibration isolators are specified Section 230548 – Vibration and Seismic Controls for HVAC.

G. Verify locations of thermostats, and other exposed control sensors with Drawings and room details before installation.

H. Install new filters in fan-coil unit within two weeks after ~~Substantial~~ Final Completion. **ADD-3**

3.3 FIELD-INSTALLED REFRIGERANT PIPING

A. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

B. Install piping adjacent to unit to allow service and maintenance.

C. Piping shall be copper with joints brazed with 15 percent silver, silphos brazing rod.

D. Elbows shall be of the long radius type.

E. Refrigerant piping shall be insulated with 1-inch-thick closed cell rubberized insulation.

F. Piping shall be secured to structure with straps, taking care to ensure that the liquid line does not contact the structure and that the insulation is not torn.

G. Piping shall be purged with dry nitrogen prior to evacuation and charging with refrigerant.

H. Piping installation requirements are specified in 232300 – Refrigerant Piping. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect condensate drain to indirect waste.
    a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

I. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

J. Connect wiring according to Section 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust components, assemblies and equipment installation, including connections. Report results in writing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature setpoints.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain fan-coil units.

END OF SECTION

SECTION 238219
FAN COIL UNITS

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. This section includes chilled water fan coil units and accessories.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Achievement of LEED-NC v2009 requires specific forms of documentation as part of the materials submittals to document certain product properties. Review the LEED Requirements Section 018113 of this Specifications Manual. Provide submittals as required in Section 018113-1.4 for all relevant materials in this section.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 – Operation and Maintenance Data, include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.4 MAINTENANCE MATERIAL SUBMITTAL

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Coil Unit Filters: Furnish one spare filters for each filter installed.
2. Fan Belts: Furnish one spare fan belt for each unit installed.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 – "Systems and Equipment" and Section 7 – "Construction and Startup."

C. ASHRAE / IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE / IESNA 90.1-2004, Section 6 – "Heating, Ventilating, and Air-Conditioning."

1.6 COORDINATION

A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.7 WARRANTY

A. Warranty: The equipment purchaser shall be provided, at no additional cost, a standard parts warranty that covers a period of ~~one~~ two years from date of final completion ~~from unit start-up or 18 months from shipment, whichever occurs first~~. This warrants that all products are free from defects in material and workmanship and have capacities and ratings set forth in the equipment manufacturer's catalog and bulletins. **ADD-3**

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: ~~Four~~ Two Years from date of ~~Substantial~~ Final completion. **ADD-3**

PART 2 PRODUCTS

2.1 FAN COIL UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide either the named product in the drawing schedule or a comparable product by one of the other manufacturers specified

1. Trane.
2. Daikin.
3. Or equal.

B. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

C. Coil Section Insulation: 1/2-inch thick, coated glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Main and Auxiliary Drain Pans: Stainless steel or Insulated galvanized steel with plastic liner. Fabricate pans and drain connections to comply with ASHRAE 62.1.

E. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.

F. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.

1. Vertical Unit Front Panels: Removable, steel, with integral stamped steel discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped discharge grilles.
3. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by Architect from manufacturer's standard colors. Return grille shall provide maintenance access to fan-coil unit.
4. Steel recessing flanges for recessing fan-coil units into ceiling or wall.

G. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Washable Foam: 70 percent arrestance and 3 MERV.
2. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
3. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

I. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Wiring Termination: Connect motor to chassis wiring with plug connection.

J. Control devices and operational sequences are specified in Section 230900 "INSTRUMENTATION AND CONTROLS FOR HVAC" and Section 230993 "SEQUENCE AND OPERATIONS FOR HVAC CONTROLS.

K. EMCS Interface Requirements.
1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation.
3. Provide BACnet interface for central EMCS workstation for the following functions.
   a. Adjust set points.
   b. Fan-coil-unit start, stop, and operating status.
   c. Data inquiry, including supply- and room-air temperature.

L. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan-coil units level and plumb.

B. Install fan-coil units to comply with NFPA 90A.

C. Suspend fan-coil units from structure with hangers. Vibration isolators are specified Section 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT.

D. Verify locations of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.

E. Install new filters in each fan-coil unit within two weeks after ~~Substantial~~ Final Completion. **ADD-3**

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
1. Install piping adjacent to machine to allow service and maintenance.
2. Connect condensate drain to indirect waste.
   a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

B. Ground equipment according to Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

C. Connect wiring according to Section 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports.
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
   3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature setpoints.

B. Occupancy Adjustments: When requested within 12 months of date of ~~Substantial~~ Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to the Project during other than normal occupancy hours for this purpose. **ADD-3**

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain fan-coil units. Refer to Section 01 79 00 – Demonstration and Training.

END OF SECTION

SECTION 260530
CONDUIT AND WIRE

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General provisions and requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Product Data Sheets for all Wire, Supports, Conduit, Fittings and Splicing Materials.

B. Submit Material List for all Conduit and Conduit Fittings.

C. Submit Details and Structural Engineering Calculations for Conduit Support Systems.

PART 2 PRODUCTS

2.1 CONDUIT

A. General

1. The interior surfaces of conduits and fittings shall be continuous and smooth, with a constant interior diameter. Conduits and conduit fittings shall provide conductor raceways of fully enclosed circular cross section. The interior surfaces of conduits and fittings shall be without ridges, burrs irregularities or obstructions. Conduits and fittings of the same type shall be of the same uniform weight and thickness.
2. Type of conduit, type of conduit fittings and conduit supports shall be suitable for the conditions of use and the conditions of location of installation, based on the Manufacturer's recommendations and based on applicable Codes.
3. All fittings for metal conduit shall be suitable for use as a grounding means, pursuant to the applicable Code Requirements. All metal conduit and metal conduit fittings shall provide 3 second duration ground fault current carrying ratings, when installed and connected to the respective conduit, as follows:
   a. RMC and EMT conduit fittings.
      1) 0.5 inch through 1.5 inch conduit/fitting size - 10,000 amp RMS.
      2) 2.0 inch and larger conduit/fitting size - 20,000 ampere RMS.
   b. FMC and LTFMC Conduit Fittings
      1) 0.5 inch through 1.25-inch conduit/fitting size-1,000 amp RMS (without external bonding jumper).
      2) 1.5 inch through 4.0-inch fitting size-10,000 amp RMS with bonding jumper.
4. Protective corrosion resistant finish for metal conduit fabricated from steel and metal conduit fittings fabricated from steel, shall be as follows:
   a. Clean all metal surfaces (including metal threads) with acid bath "pickle" prior to coating, to remove dirt, oil and prepare surfaces for galvanizing.
   b. Hot-dip galvanized zinc coating on all interior and exterior steel surfaces. Minimum finish zinc coating thickness shall not be less than 0.002 inches.
   c. Threads shall be hot-dip zinc coated after machine fabrication.
   d. Exterior metal surfaces shall be finished with clear organic polymer topcoat layer, after galvanizing.

e. The inner metal surfaces of conduit fittings shall be finished with a lubricating topcoat after galvanizing, to facilitate conductor pulling through the conduit/fitting.

5. Threads for metal conduit and metal conduit fittings shall be taper-pipe-thread, National Pipe Standards (NPS) and shall comply with ANSI-B1.20.1.
6. Metal conduit termination connector fittings shall be provided with a Manufacturer installed, insulating throat bushing inside the fitting. The bushing shall protect the wire conductor insulation from cutting, nicks and abrasion during conductor installation and electrical load "cycling" after installation is complete. The bushing shall comply with UL 94V-0 flammability.
7. Provide conduit bonding/grounding jumper from metal enclosures with "concentric ring" knockouts, to positively ground/bond each respective conduit(s) to the metal enclosure.
8. Metal conduit fittings connecting to PVC coated metal conduit shall be PVC coated to match the conduit.
9. The conduit and fittings shall be watertight and airtight without cracks and pinholes.

B. Rigid Metal Conduit (RMC)

1. Rigid metal, round tubing, machine threaded at both ends.
   a. The conduit and conduit fittings shall comply with the requirements for an equipment grounding conductor, pursuant to applicable Codes.
2. RMC raceway types shall be as follows:
   a. Rigid Galvanized Steel conduit (RGS), minimum yield strength shall be 35,000 PSI. Shall comply with NEMA Standard 5-19 (latest revision); ANSI C80.1 and ANSI-C80.4 (latest revision); UL 514-B and UL 6 (latest revisions); National Pipe Standard Specification (latest revision).
   b. Intermediate steel Conduit (IMC). Shall comply with NEMA Standard 5-19 (latest revision) ANSI-C80.6 (latest revision); UL 2142 (latest revision).
3. RMC fittings:
   a. Fittings shall be compatible with RGS and IMC.
   b. Fittings shall be rated "liquid tight".
   c. Fittings imbedded in concrete shall be rated "liquid tight" and "concrete tight".
   d. Connectors and couplings for terminating, connecting and coupling to RMC conduit shall be threaded metal.
   e. Fittings shall comply with ANSI C80.4 and ANSI C33-84 (latest revision); NEMA FB1 (latest revision); UL 514 (latest revision).
   f. Conduit seal fittings:
      1) Conduit seals shall prevent the passage of gasses, liquids and vapors past the location of the seal installation in the conduit.
      2) Conduit seals shall be suitable for installation in both vertical and horizontal conduit locations.
      3) Conduit seals shall be visible and accessible for inspection after installation is complete.
      4) Conduit seals shall be rated for the following locations:
         a) Wet locations
         b) Classified hazardous location materials NEC Class 1 Division 1.
         c) Temperature ranges from 0 degrees centigrade through 90 degrees centigrade.
      5) Conduit seals, sealing compound and sealing compound dam shall be the products of the same Manufacturer.
4. RMC fittings as manufactured by:
   a. For threaded enclosure, termination connection.
      1) Thomas & Betts - 106 Series bonding locknut, 5302 Series sealing ring with stainless steel retainer.
   b. For non-threaded enclosure, termination connector.
      1) Thomas & Betts - 370 Series watertight threaded sealing hub, 106 Series threaded bonding lock nut, Sta-Con Series enclosure bonding jumper and 3870 Series threaded ground bushing.
      2) Emerson-OZ/Gedney-CHMT/CHT watertight threaded hub with bonding locknut and GH50G Series enclosure bonding jumper.
   c. For RMC to RMC conduit-to-conduit coupling
      1) Thomas & Betts/Erickson - 674 (threaded) Series
      2) Emerson-OZ/Gedney Type TPC (threaded) Series

3) Threaded RMC conduit couplings, product of the same Manufacturer as the RMC conduit.
d. For RMC Conduit Seals
1) Emerson-OZ/Gedney-EYA and EYAM (threaded) Series
2) Appleton-EYF and EYM (threaded) Series

C. Electrical Metallic Tubing (EMT)
1. Rigid metal round tubing, “thin wall” steel construction, with non-threaded ends.
a. The conduit and conduit fittings shall comply with the requirements for an equipment grounding conductor pursuant to applicable Codes.
b. The conduit shall be watertight and airtight without cracks and pinholes.
2. EMT shall be allowed for conduit size ranges from 0.5-inch through 4.0-inches.
3. Comply with ANSI C80.3, C80.4, and ANSI C33.98 (latest revisions); UL 594 and UL 797 (latest revisions); CEC Section 12500 (latest revision).
4. EMT fittings:
a. Connectors and couplings for terminating, connecting and coupling to EMT conduit shall be non-threaded steel fabrication.
b. EMT termination connector fittings shall be as follows:
1) Set screw type “concrete tight” when installed in dry interior locations.
2) Compression types “raintight” and “concrete tight” when installed in wet or damp locations, outdoors and in concrete or masonry construction.
c. Fittings shall comply with ANSI C33.84 (latest revision); UL 514 (latest revision); NEMA FB-1.
5. EMT fittings as manufactured by:
a. For threaded and non-threaded enclosure, termination connector
1) Thomas & Betts-TC721A (set screw type) Series (with locknuts).
2) Emerson-OZ/Gedney-TC500I (set screw type) Series (with locknuts).
3) Thomas & Betts-5123 (compression type) Series (with 2 locknuts).
4) Emerson-OZ/Gedney-TC600I (compression type) Series (with locknut).
5) Thomas & Betts-4240 (compression type) Series (90 degree angle with locknut).
6) Emerson-OZ/Gedney-TWL (compression type) Series (90 degree angle with locknut).
b. For EMT to EMT conduit-to-conduit coupling:
1) Thomas & Betts-TK121A (set screw type) Series (with locknut).
2) Emerson-OZ/Gedney-5000 (set screw type) Series (with locknut).
3) Thomas & Betts-5120 (compression type) Series.
4) Emerson-OZ/Gedney-TC600 (compression type) Series.
c. For EMT to RMC conduit to conduit combination coupling:
1) Thomas & Betts-HT221 (set screw type) Series.
2) Emerson-OZ/Gedney-ESR (set screw type) Series.
3) Thomas & Betts-530 (compression type) Series.
4) Emerson-OZ/Gedney-ETR (compression type) Series.

D. Flexible Metal Conduit (FMC)
1. Round flexible conduit, fabricated from a single continuous steel strip. The steel shall be factory formed into continuous interlocking convolutions to form a complete lock between steel strips and provide raceway flexibility.
2. Metal to metal grounding contact shall be maintained throughout the length of the FMC conduit.
3. FMC shall be allowed for conduit size ranges from 0.5 inch through 4.0-inches.
4. FMC shall comply with ANSI-C.33.84 and ANSI C33.92; NEMA FB-1; CEC 12-1100.
5. FMC Fittings
a. FMC fittings shall be malleable iron construction or steel construction.
b. Fitting shall automatically cause the FMC raceway throat opening to be centered with respect to the fitting throat opening.
c. Straight and angled connector termination fittings shall be threaded on one end and shall include a threaded locknut, suitable for connection to threaded and unthreaded enclosures.
d. The attachment of the fittings to FMC shall be angled saddle type, to engage and interlock with the FMC spiral groove, and shall be unaffected by vibration. Direct bearing screw type fittings shall not be used.
e. Direct FMC conduit-to-FMC conduit coupling of FMC shall not be permitted.

f. Shall comply with ANSI C33.9, and ANSI C33.92 (latest revision); NEMA FB1 (latest revision); UL 514.

6. FMC fittings as manufactured by:
   a. Straight Termination Connectors — Thomas & Betts-3110 Series (with locknut)
      45 and 90 Degree Angle Connectors — Thomas & Betts-3130 Series (with locknut)
   b. FMC to EMT conduit combination coupling: Thomas & Betts 503TB Series.

E. Liquid Tight Flexible Metal Conduit (LTFMC)

1. The metal conduit core of LTFMC shall comply with the same requirements as FMC conduit, with the addition of a thermoplastic exterior flexible jacket over the metal core.
2. The exterior jacket shall be positively locked to the metal core to prevent jacket "sleeving".
3. The LTFMC shall be rated for installation and operating service temperatures of between minus 20 degrees centigrade through plus 90 degrees centigrade.
4. The LTFMC jacket shall be suitable for continuous exposure to sunlight, rainwater, water vapor, mineral oils and liquid solvents, without penetrating into the conduit and without deteriorating the jacket.
5. LTFMC sizes from 0.5-inch through 1.25-inch shall include an additional internal ground conductor, fabricated by the Manufacturer, as an integral part of the conduit core.
6. Direct LTFMC conduit-to-LTFMC conduit coupling of LTFMC shall not be permitted.
7. LTFMC shall be allowed for conduit size ranges from 0.5-inch through 4.0-inches.
8. In addition to the requirements for FMC conduit, LTFMC shall also comply with ANSI C-33.84 (latest revision); NEMA-FB1 (latest revision); CEC 12-1400 (latest revision).
9. LTFMC fittings
   a. Fittings shall include an external mechanical ground/bond wire connector.
   b. The attachment of the fitting to LTFMC shall be threaded compression type onto the conduit core with locknut and liquid tight jacket compression seal. The fitting shall automatically prevent "sleeving" of the jacket.
   c. Straight and angled termination connector fittings shall be threaded on one end and shall include locknut suitable for connection to threaded and unthreaded enclosures.
10. LTFMC fittings as manufactured by:
    a. Termination connector fittings:

Straight	45 and 90 Degree Angle Connectors
· Thomas & Betts-5331 GR Series.	Thomas & Betts-5341GR & 5351GR Series.
• Appleton-STB & STN-L Series for use w/ preformed "knockouts".	Appleton-STB-L Series; STN-L Series for use with preformed "knockouts".
· Emerson- OZ/Gedney-4Q Series.	Emerson-OZ/Gedney-4Q Series

    b. LTFMC to RMC conduit to conduit combination coupling fittings:
       1) Thomas & Betts-5271 GR Series.
       2) Emerson-OZ/Gedney-4Q Series

F. Rigid Non Metallic Conduit (RNMC)

1. General
   a. Conduit and fittings shall be 90 degree centigrade conductor rated. Fabricated from homogeneous material, free from visible cracks, holes or foreign inclusions, with integral "end-bell". The conduit and conduit fittings shall be watertight and airtight.
   b. Conduit, conduit fittings and conduit fitting assembly "solvent cement" shall all be the product of the same Manufacturer. Conduit fittings shall be solvent cement welded watertight.
   c. Conduit and fittings shall be identified with legible markings showing ratings, size and Manufacturers name.
   d. RNMC and fitting shall be corrosion resistant, watertight.
   e. Conduit shall be suitable for conductor operating temperatures from minus 20 degrees centigrade to 90 degrees centigrade.
   f. RNMC shall comply with NEMA TC-2 (PVC 40 conduit, latest revision) NEMA TC-6 (EB conduit latest revision) and NEMA TC-3 (fittings, latest revision); UL 514 and UL 651 (latest revision).

2. Polyvinyl Chloride (PVC)-RNMC
   a. PVC-schedule 40 heavy wall construction.
   b. PVC-schedule 80 extra heavy wall construction.
   c. PVC-type EB.
3. RNMC fittings connecting to metallic raceways shall be provided with a ground/ bond jumper connection.

G. Combi-Duct
1. Rigid nonmetallic conduit combining a continuous linear outer raceway (duct) with factory installed (inside the outer duct) multiple, segregated inner raceway (ducts). Rigid, schedule 40 PVC construction. Shall be modular lengths of 20-feet for each duct segment.
2. The conduit shall be suitable for use with signal/telecommunications, fiber optic, telephone and computer/data circuits, operating at 100 volts or less, UL listed and labeled.
3. Outer Duct, outer enclosing Schedule-40 PVC duct size. The outer enclosing duct shall be 4.2-inches inside nominal duct diameter and 4.5-inches outer duct nominal diameter.
4. Inner-ducts (contained inside the enclosing outer duct), non-metallic SDR-19 or Type-C/CAO-8546:
   Triple Combi-Duct
   a. Quantity of three continuous round rigid inner linear ducts, nominal size inside diameter 1.5-inch for each inner duct.
   Quad Combi-Duct
   b. Quantity of four continuous round rigid inner linear ducts, nominal size inside diameter 1.19-inch for each inner duct.
5. Manufacturer's standard bends and offsets, minimum 72-inches radius.
6. Combi-duct and combi-duct fittings shall be airtight and watertight. Approved for direct burial in earth and approved for encasement in concrete.
7. As manufactured by Carlon # Multi-Guard/Multi-Cell Series; American Pipe and Plastic (AMTEL) #Multi-Bore Series; or equal.

H. Expansion Joint, Deflection Joint and Seismic Joint Conduit Fittings
1. Expansion Conduit Fitting - Fitting shall provide for a minimum of 2-inches straight line movement between two connecting conduits in each direction (total 4-inches conduit expansion and Contraction) parallel to the respective conduit lengths. Fitting shall be watertight.
2. Deflection Conduit Fitting - Fitting shall provide for a minimum of 30 degrees angular deflection movement ("Shear" deflection) between two connecting conduits, in any direction perpendicular to the length of the respective conduits. Fitting shall be watertight.
3. Combination Expansion/Deflection Conduit Fitting - Fitting shall provide the combined "expansion" and "deflection" movement capacity between two connecting conduits as described for separate "expansion" and "Deflection" conduit fittings. Fitting shall be approved for installation concealed in both masonry/concrete construction and exposed non-masonry/ concrete construction. Fitting shall be watertight.
4. Fittings shall comply with UL.
5. Fittings as manufactured by:
   a. Conduit expansion fittings exposed or concealed locations as manufactured by:
      1) Emerson-OZ/Gedney – AXB-8 Series for RMC conduit.
      2) Emerson-OZ/Gedney - TX Series for EMT conduit.
      3) Appleton – AXB or XJ8 Series for RMC conduit and EMT conduits. Provide RMC to EMT combination conduit coupling fittings for each end of the expansion fitting.
   b. Combination expansion/deflection conduit fittings exposed or concealed conduit locations as manufactured by:
      1) Emerson-OZ/Gedney - AXDX Series for RMC conduit.
      2) Emerson-OZ/Gedney - AXDX Series for EMT conduit.
      3) Appleton-DX Series for RMC conduit.
      4) Provide RMC to EMT combination conduit coupling fittings for each end of the expansion/deflection fitting.
   c. Conduit expansion/deflection fittings for FMC and LTFMC conduit.
      1) Provide a minimum of 12-inches of "slack" LTFMC in each FMC or LTFMC conduit at building and structure seismic or expansion joint conduit crossings.

2) Note: Each FMC “slack” expansion/deflection location, shall be considered as not less than a 90 degree conduit bend location, for compliance with the maximum quantity of conduit bends allowed in a raceway.

6. Conduit fitting bonding jumper:
   a. The grounding/bonding path of metal conduit shall be maintained by the fitting.
   b. Provide a bonding jumper at each expansion, deflection and combination expansion deflection conduit fitting.
   c. The jumper shall be a bare flexible copper “braid”. The copper braid electrical current carrying capacity shall be equal to the metal conduit.
   d. Provide a factory terminated ground clamp on each end of the braid with adjusting steel conduit grounding clamps and connect to each respective conduit end.
   e. The jumper braid length shall be 8-inches longer than the respective conduit fitting.
   f. Bonding jumper for FMC and EMT fittings as manufactured by:
      1) Emerson-OZ/Gedney – BJ and BJE Series
      2) Appleton – BJ/XJ Series

I. Conduit Bodies Conduit Fitting
   1. Conduit bodies shall provide conductor access with a removable conduit body cover and wiring area enclosed in metal housing. The conduit body shall facilitate pulling conductors.
   2. In-line form “C” conduit bodies shall be prohibited.
   3. The interior space “length” of 90 degree “elbow” conduit bodies shall not be less than six times the diameter size of the largest conduit connecting to the conduit body.
   4. Conduit body covers shall be removable, gasketed; watertight “domed” metal covers “Mogul-Type” with threaded screw attachment to the conduit body.
   5. Lubricated, reusable, wire roller guards inside the conduit body shall protect wire from insulation damage during wire “pulling”.
   6. Conduit body fittings shall comply with UL 514.
   7. Conduit bodies as manufactured by:
      a. For RMC Conduit
         1) Hubbell/Killark – LB/Mogul (90-degree elbow) Series – threaded body.
         2) Emerson-OZ/Gedney - LB 6X/Mogul (90 degree elbow) Series - threaded body.
         3) Appleton – NEC6X-LB/Mogul (90 degree elbow) Series - threaded body.
      b. For EMT Conduit
         1) Same as for RMC conduit. Provide EMT to RMC conduit combination coupling fitting for each outlet body connection.

2.2 PVC COATING

A. PVC Coatings shall be provided as described for specified metal products.

B. PVC Coating shall be factory applied, to comply with NEMA-RN1 and 5-19.

C. The Adhesion of the PVC coating to the coated metal shall exceed the strength of the coating itself, based on 0.5-inch “strip-pull” test.

D. Uniform Coating Thickness shall be continuous without “breaks” or “pinholes” and shall not be less than the following:
   1. Exterior metal surfaces, 40-millimeter coating thickness.
   2. Interior metal surfaces, 10-millimeter PVC or urethane coating thickness (i.e. interior of conduits, interior of conduit fittings etc.).

2.3 CONDUIT SUPPORTS

A. General
   1. Conduit Supports, hangers and fasteners for metal conduit shall be steel, hot dip zinc galvanized.
   2. Conduit supports, hangers and fasteners for PVC coated conduit shall be PVC coated to match the conduit PVC coating.
   3. Threaded hardware shall be continuous, free running threads.

4. Conduit support systems, including support channels, pipe clamps, braces, anchors, hardware, fasteners, shall be sized to support the full capacity circuit conductors weight, plus the installed conduit weight, plus the conduit fitting weight and support hardware weight, plus a 300% additional weight capacity safety factor.
5. Provide lock washer at each “bolted”/threaded connection.
6. Conduit supports, fasteners, channels, braces, hardware, anchors, pipe clamps, and hangers as manufactured by Unistrut or Kindorf.
7. Supports shall be free of “BURRS” and sharp edges.
8. Metal supports cut in the field shall be zinc galvanized after cutting to prevent rust.

B. Conduit Hangers
1. Threaded steel hanger rods.
   a. Hanger rods smaller than 0.375-inches in diameter shall not be used for support of individual conduits.
   b. Hanger rods smaller than 0.5-inches in diameter shall not be used for support of multiple conduits.
2. Conduit hanger wires shall be not less than 12-gauge steel.
3. Conduit hangers shall attach to structure fasteners with steel “Clevis” or “Swing” hangers and shall provide a minimum of 45 degrees of angular movement in any direction at the point of the conduit hanger attachment to the structure fasteners.
4. Conduits individually suspended by conduit hangers shall fasten to the respective hangers with “Clevis” type pipe hangers. The pipe hangers shall be steel, adjustable to fit conduit size and shall completely enclose the conduit circumference.

C. Conduit Support Channels
1. “C” channels shall be factory preformed with a minimum 12 gauge thickness metal. The channel shall be factory “punched” with regularly spaced slotted holes for fastener attachments along the length of the channel.
2. The “C” channel shall not deflect more than 0.1 inch between channel supports at maximum installed design load, including required safety factor.
3. Channels shall comply with ANSI-1008 (latest revision) and ASTM-A569 latest revision).
4. Channels shall provide “turned lips” at longitudinal edges to hold (lock-in) fasteners.
5. Conduit support channels suspended from conduit hangers shall attach to conduit hangers with treaded connections. Provide a minimum of two hangers (trapeze style) connected to each channel.
6. Non-suspended conduit support channels shall connect to structure fasteners with threaded connectors.

D. Fasteners, Seismic Earthquake Rated
1. Channel fasteners:
   a. Channel fasteners shall “prelocate” and lock into the channel “turned lips” and channel “walls”.
   b. A separate metal strap shall “tie” each conduit to each channel with conduit channel fasteners.
2. Structure fasteners:
   a. Structure fasteners for wall and floor mounted conduit attachments shall attach to existing masonry and concrete structures with structure fasteners using drilled, mechanical, expansion shield anchors.
   b. Structure fasteners for wall and floor mounted conduit attachments shall attach to new masonry and concrete structures with structure fasteners using steel threaded inserts precast into the structures.
   c. Structure fasteners shall center the support load above or below the beam flanges and reduce torsion-rotation forces exerted on the structural beam. Attach to steel structural members with “swing-beam clamps”, with set-locking screw structure fasteners.
      1) Beam clamps shall include integral safety rod, strap or “J”-hook to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.
      2) Or double-ended beam clamp to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.

d. Structure fasteners for wall and floor mounted conduit attachments shall attach to wood structural members with flush “through-bolted” wood beam/wood framing stud structure fasteners.
e. Structure fasteners for wall mounted conduit attachments shall attach to steel framing studs and steel structural elements with spot welded steel structure fasteners or drilled and bolted structure fasteners.

E. Brace Connectors

1. Provide lateral brace connectors to resist horizontal, lateral and vertical movement of suspended conduits during seismic earthquakes.
2. The braces shall connect from each conduit support, attach as close to the conduit as possible, and attach to fixed rigid, nonsuspended building “main” structural elements with fixed anchoring.
3. Brace attachment connectors and fasteners shall be rigid preformed steel channels or flexible #10 gauge steel hanger wire.
4. Connect and attach the brace connectors to fixed structural elements in the same manner as conduit support hangers. The connection of braces to structural elements shall be independent of the conduit support hanger structure fasteners.

2.4 ELECTRICAL POWER WIRE AND CABLE

A. General

1. All wire and cable shall be single-conductor, annealed copper, insulated 600 volt, #12AWG minimum unless specifically noted otherwise on the Drawings.
2. Conductors #10AWG and smaller shall be solid. Conductors #8AWG and larger shall be stranded.
3. Insulation of conductor connected to circuit protection devices required to be "100%" rated, shall be 90 degree centigrade rated insulation.
4. Insulation of conductors installed outdoors, on grade or underground, insulation shall be rated for wet locations.
5. Insulation of conductors installed outdoors, installed exposed to the sun, installed in exposed conduits, insulation shall be rated for high-temperature 90 degrees centigrade.
6. Insulation of branch circuit conducts installed in light fixtures, insulation shall be rated for 90 degrees centigrade.
7. Conductor exposed to oil, insulation and jacket shall be oil resistant, complying with “Oil Resistant-1” and “Oil Resistant-2” UL 83.

B. Conductor Insulation

1. 600 Volt AC and/or DC insulated conductors installed entirely inside conduits, or enclosed inside wireways, or enclosed inside raceways, insulation shall be rated as follows.
2. Indoor above Grade locations either concealed or exposed.
   a. Dual rated THHN and THWN
   b. Individually rated THHN-2
   c. Individually rated THWN-2
   d. XHHW-2
3. Outdoor above Grade either concealed or exposed.
   a. XHHW-2
   b. THWN-2
   c. THW-2
4. Outdoor below Grade or outdoor on Grade.
   a. XHHW-2
   b. THWN-2
   c. THW-2
5. All other enclosed raceway locations not described above.
   a. XHHW-2
   b. THWN-2
   c. THW-2
6. Health Care facilities all circuits insulation shall be XHHW-2, rated Hospital-Grade.

7. 600 Volt AC and/or DC insulated conductors installed in open cable tray or open wireway or exposed insulation also shall be rated for exposed install locations.

C. Insulation Color Coding and Identification

1. The following color code for branch circuits:
   a. Neutral . . . White (Tape feeder neutrals with white tape near connections)
   b. Normal Power:

120/208 Volt	480/277 Volt	
Ground Green	Ground Green	
Phase A Black	Phase A Brown	***ADD 3***
Phase B Red	Phase B Orange	
Phase C Blue	Phase C Yellow	

   c. Isolated ground insulation shall be green with a longitudinal yellow stripe.
   d. Emergency power same insulation color as normal power except as follows:
      120/208 Volt and 277/480 Volt ***ADD 3***
      Provide a continuous stripe on each conductor insulation, orange or yellow, except ground
2. When individual neutral conductors are shown for each branch circuit, the color code for the neutral conductors shall be as follows:
   a. 120/208 volt; Phase A - White with Black stripe; Phase B - White with Red stripe; Phase C - White with Blue stripe.
   b. 277/480 volt; Phase A - White with Brown stripe; Phase B - White with Orange stripe; Phase C - White with Yellow stripe. ***ADD 3***
3. Feeders identified as to phase or leg in each, switchboard, switchgear, panelboard and junction location with printed identifying tape.
4. Fire alarm conductors: Use 600-volt, type THHN-2/THWN-2 conductors and color-coded per Equipment Manufacturer's recommendations and approved and listed for use on fire alarm systems by the State Fire Marshal.
5. Color coding for mechanical and plumbing control wiring shall be an agreed upon color code between the Mechanical/Plumbing Contractor and the Electrical Contractor, and color code shall be submitted to the District's Representative in writing for approval prior to installation.

D. Panel Feeders, Copper or Aluminum:

1. Wire size shown on the Drawings is for copper conductors, unless specifically indicated otherwise.
2. If aluminum wire is proposed, increase wire size to ampere capacity of copper wire and voltage drop not to exceed that of copper feeders indicated on Drawings. Increase conduit size and quantity as required by Code. Provide feeder calculation sheet, eight copies, if aluminum wire is proposed, showing feeder number, length, size and voltage drop in percentage for original copper feeders and for equal aluminum feeders.
3. Aluminum Conductors (600 Volt or Less Only): Contractor has the option of using aluminum conductors in lieu of copper conductors for feeders only to panels, distribution boards/panels, switchboards, switchgear, transformers, motor control centers, and dimmer switchboard.
4. Aluminum Conductors shall be Aluminum Association AA-8000 Series Alloy, compact-stranded, with the same insulation as called for under copper conductors.
   a. Aluminum conductor larger than 750 MCM shall not be used.
   b. Aluminum conductors smaller than #2AWG shall not be used.
5. If the conductor termination is to be made on a bus bar or similar flat surface, a Burndy Type YA-A HYPLUG compression terminal intended for the specific conductor size, factory filled with oxide inhibitor compound shall be used. Terminal must be installed using a hydraulic compression tool equipment with a die head for the particular terminal used. Only Burndy Hypress tools shall be used for compression.
6. If the conductor termination is to be made into a circuit breaker or similar insert compartment it shall be terminated by use of a Burndy AYP HYPLUG compression connector intended for the specific conductor size, factory filled with oxide inhibitor compound. Connector must be installed using only Burndy Hydraulic compression tool specifically approved for each respective connector.
7. Connector aid shall be used for all terminations and connections. Connector aid shall be Burndy Pentrox A, NO-OX-1D Grade "A".

8. When an aluminum lug is terminated to a copper bus with a steel or copper stud or bolt, place aluminum lug on stud or bolt followed by a flat steel washer, a Belleville washer, and steel or copper nut, in that order.

2.5 CHEMICAL GROUND ROD

A. General
   1. Self-contained ground rod(s) using chemically enhanced grounding shall be provided where specifically indicated on the Drawings. As manufactured by Lyncole XIT Grounding Systems, 22412 South Normandie Avenue, Torrance, CA. Telephone #(800) 962-2610; or Superior Grounding Systems, Irwindale, CA. Telephone #(800) 747-7925; or ERICO – Eritech Chemical Ground Electrode.
   2. The ground rod shall operate from changes in atmospheric pressure pumping air through the ground rod, hygroscopically extracting moisture from the air to activate the ground electrolytic chemicals and improve the ground rod performance.
   3. Ground rod system shall be UL-467 listed.
   4. Ground rod system shall be 100% self-activating, sealed and maintenance free. The addition of chemical or water solutions shall not be required.

B. Ground Rod
   1. Ground rod shall consist of a 2-inches nominal diameter hollow, copper tube. The tube shall be permanently capped on the top and bottom. Air breather holes shall be provided in the top of tube. Drainage holes shall be provided in the bottom and sides of the tube for electrolyte drainage into the surrounding soil.
   2. The ground rod shall be chemically filled at the factory with environmentally non-hazardous water-soluble metallic salts to enhance electrical grounding performance.
   3. Ground rod shall be a minimum of 10-feet long for straight (vertical) installation; or “L” shape minimum 20-feet long for horizontal installation.
   4. Ground wire clamping “U-Bolt” with pressure plate on the top end of the tube sized for 1#2 through 500 MCM AWG ground electrode conductor connection, and stranded 4/0AWG copper pigtail exothermically welded to the side of rod for ground electrode conductor connection.

C. Ground Box
   1. Precast concrete box with slots for conduit entrances. Approximately 10-inch diameter by 12-inches high. Cast iron grate flush cover with “Breather” slots XIT Box #XB-12.

D. Backfill Material
   1. Natural volcanic, non-corrosive Bentonite Clay backfill material.
   2. Shall absorb water at a minimum of thirteen times its dry volume or approximately 14 gallons for 50 pounds of clay.
   3. PH value 8-10 with maximum resistivity of 2.5 OHMS-M at 300% moisture content by weight.

2.6 FLEXIBLE CORDS AND PORTABLE CABLES

A. General
   1. Multi-conductor insulated flexible cable with jacket rated extra heavy duty, extra hard-use and high abuse duty; ozone, sunlight, grease, oil resistant-UL 83 and water resistant; rated for indoor/outdoor use.
   2. Quantity of conductors and conductor sizes as indicated on the Drawings but in no case less than five 16AWG.
   3. Characteristics:
      a. Conductors - stranded copper, soft annealed conforming to ASTM-B-174 and ASTM-B-172. 600 volt individually insulated and color-coded. Separate green insulated ground conductor. Aluminum conductors shall not be permitted for cords and cables.
      b. Insulation - rubber conforming to UL 62; temperature range plus 105° Centigrade to minus 50° Centigrade.
      c. Flame resistance shall conform with MSHA-P123-103.
      d. Jacket - black for equipment connections and yellow for outlet connections. Rated for temperature range plus 105° Centigrade to minus 50° Centigrade, water, sunlight and

ozone resistant. Permanently mark jacket a minimum of 40-inches on center with rated voltage, Manufacturer's name, wire/insulation type, AWG conductor size and quantity (minimum 24-inches on center).

2.7 CABLE RACKS

A. Cable Racks, installed on the vertical walls of the structure, including hooks and porcelain insulator cable cradles, shall be sufficient to accommodate the cables and splices.

B. Vertical Racks shall be installed on all walls of the structure a minimum of 24-inches on center within 6-inches of floor and top of wall. A rack shall be installed within 18-inches of each corner of each wall. Additional racks spaced equally on each wall shall be installed; spacing between vertical wall racks shall not exceed 24-inches.

1. Wall racks shall be slotted to accept removable hooks and lock hooks into place.
2. Non-metallic, 50% (minimum) glass reinforced nylon or non-metallic material of the same characteristics.
3. The installed cable racks, cable support hooks with arms and wall anchor bolts shall support the following minimum loads for each hook/arm, with a 200% minimum safety factor. Based on multiple hook/arms located not less than 9-inches on center along the entire vertical length of the support rack:

Hook/Arm Length	Min. Weight Each Hook/Arm Supported	Max. Allowable Hook/Arm Deflection
a. 8-inches	450 pounds	0.25-inch
b. 14-inches	350 pounds	0.37-inch
c. 20-inches	250 pounds	0.37-inch

(Based on load concentrated 1-inch from the end of each hook/arm.)

4. Racks shall be bolted to the precast and cast-in place structure walls, within 3-inches of each rack end and not less than 9-inches on center. Provide cast-in place or after-set drilled expansion concrete anchors.

PART 3 EXECUTION

3.1 TRENCHING, FOOTINGS, SLEEVES

A. Provide Trenching, Concrete Encasement of conduits, backfilling, and compaction for the underground electrical work, in accordance with applicable Sections of this Specification.

B. Provide Footings for all post and/or pole-mounted lighting fixtures: concrete shall conform to the applicable Sections of this Specification.

C. Sleeves

1. Provide sleeves for raceways, conduit and wire/cables passing through the following construction elements:
   a. Concrete and masonry foundations, floors, walls and slabs.
   b. Gypsum, Lath, and plaster walls and ceilings.
   c. Building structures (i.e., foundations, walls, floors, ceilings, beams, and roofs) with a fire rating exceeding 20-minutes.
2. Sleeves shall extend 1.5-inch above and below floors, except under floor standing electrical equipment. Sleeves shall be flush with wall ceiling foundations and partitions exposed to public view and extend approximately 0.5-inch past penetration in fire rated construction. Sleeves shall be installed at exact penetration locations and angles to accommodate wire/cable, raceway and conduit routings.
3. Joists, girders, beams, columns or reinforcing steel shall not be cut or weakened. Where construction necessitates the routing of conduit or raceways through structural members, framing or footings, written permission to make such installation shall first be obtained from the District's Representative. Such permission will not be granted, however, if any other method of installation is possible.
4. The layout and design of raceways and conduits located in or routed through masonry or reinforced beams or the District's Representative shall review walls before any work is

performed. All sleeving shall be accomplished according to the instructions of the District's Representative and shall be accepted before any concrete is poured.

5. Sleeves, raceways and conduit shall be located to clear steel reinforcing bars in beams. Reinforcing bars in walls shall be offset to clear piping and sleeves.
6. Provide a continuous clearance between the inside of a sleeve and exterior of wire/cables, conduits and raceways passing through the sleeve not less than the following:
   a. 0.5-inch clearance except as required otherwise.
   b. 1.0-inch clearance through outside walls below grade.
   c. 3.0-inch clearance through seismic joints.
7. Sleeves set in fire rated construction shall be caulked between sleeve and building structure, additionally sleeves shall be caulked between the sleeve and the wire/cables, conduits/ raceways passing through the sleeve. The caulking shall be a fireproof sealant, equal to the fire rating and temperature being penetrated. Clearance between components inside of sleeve and exterior of components passing through sleeve and between components inside the sleeve shall comply with Fireproof Sealant Manufacturer's recommendations.
8. Sleeve material:
   a. In floor construction: Schedule 40 black steel pipe, with upper surface to be sealed watertight.
   b. In concrete or masonry walls roofs or ceilings: Schedule 40 black steel pipe. When installed in roofs or outside walls, seal outer surface watertight.
   c. In fire rated construction; 24 gauge galvanized iron or steel.
   d. Sleeves through waterproof membranes: Cast iron or Schedule 40 steel with flashing clamp device and corrosion resistant clamping bolts. Caulk space between pipe and sleeve and surfaces between sleeve and conduits sealed watertight.

3.2 GROUNDING

A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State and Local Authorities Having Jurisdiction.

B. Where Nonmetallic Conduit is used in the distribution system, the Contractor shall install the proper sized copper ground wire in the conduit with the feeder for use as an equipment ground. The electrical metallic raceway system shall be grounded to this ground wire.

C. The Maximum Ground/Bond Resistance to the grounding electrode shall not exceed 1 ohms from any location in the electrical system. The maximum ground resistance of the grounding electrode to earth shall not exceed 5 ohms.

D. Ground/Bond Conductors
   1. Provide an additional, dedicated, green insulation equipment ground/bond wire inside each conduit type and raceway as follows. Size the ground/bond conductors to comply with CEC/ NEC requirements. The metal conduit or raceway shall not be permitted to serve (function) as the only (exclusive) electrical ground return path:
      a. All types of nonmetallic conduit and all types of non-metallic raceways including but not limited to: RNMC - Rigid Nonmetallic Conduit.
      b. FMC - Flexible Metal Conduit.
      c. LTFMC - Liquid Tight Flexible Metal Conduit.
      d. Metal and non-metal raceways.
      e. RMC - Rigid Metal Conduit.
      f. EMT - Electrical Metal Tubing.
   2. The equipment ground/bond wire shall be continuous from the electrical circuit source point of origin to the electrical circuit end termination utilization point as follows:
      a. Every conduit and raceway path containing any length of the above identified conduits or raceway.
      b. Every conduit path and raceway path connected to any length of the above-identified conduits and raceways.

3. The equipment ground/bond wire shall be sized as follows, but in no case smaller than indicated on the Drawings. Install equipment ground/bond wire in each conduit/raceway, with the respective phase conductors:
   a. Feeder, Subfeeders and Branch Circuit Protection — Min. Equip. Grnd Wire Size

15 Amp	#12
20 Amp	#12
30 to 60Amp	#10
70 to 100 Amp	#8
101 to 200 Amp	#6
201 to 400 Amp	#2
401 to 600 Amp	#1
801 to 1000 Amp	2/0
1001 to 1200 Amp	3/0
1201 to 1600 Amp	4/0
1601 to 2000 Amp	250 MCM
2001 to 2500 Amp	350 MCM
2501 to 4000 Amp	500 MCM

4. Isolated grounds - Raceways containing branch circuit or feeder phase conductors connected to panelboards equipment, or receptacles with isolated grounds or isolated ground bus shall contain a dedicated insulated ground conductor connected to the isolated ground system only. The isolated ground conductor shall be continuous the length of the raceways and connected only to the isolated ground terminals in addition to and independent of the equipment bonding/ ground conductor. The isolated ground conductor shall be sized as indicated above, for equipment ground/bond wire.
5. Splices in ground/bond wires shall be permitted only at the following locations:
   a. Ground buses with listed and approved ground lugs.
   b. Where exothermic welded ground/bond wire splices are provided.
6. Provide ground/bond wire jumpers for conduit fittings with ground lugs, expansion and deflection conduit fittings at conduit fittings connecting between metallic and non-metallic raceways and to bond metal enclosures to conduit fittings with ground lugs.

E. Where Conductors are run in parallel in multiple raceways, the grounding conductor shall be run in parallel. Each parallel equipment-grounding conductor shall be sized on the basis of the ampere rating of the overcurrent device protecting the circuit conductors in the raceway. When conductors are adjusted in size to compensate for voltage drop, grounding conductors, where required, shall be adjusted proportionately in size.

F. Ground Conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.

G. Each Panelboard, Switchboard, Pull Box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

H. UFER Ground
   1. In addition to all cold water and structural steel grounds provided to meet this specification, there shall be a main ground system of the UFER ground style.
   2. The UFER ground electrodes shall be a minimum of two 20-feet lengths of #4/0 AWG bare stranded copper cable embedded horizontally in the cast in place concrete footing, extending in opposite directions in the footings. All portions of the ground electrodes shall be placed inside the concrete, between 2-inches and 4-inches from the earth surrounding the concrete.
   3. The lengths of cable shall extend in opposite directions in the footings, with the center end of each cable terminated onto the main electrical service ground bus for the main electrical service equipment.
   4. All wire cable connection terminations onto the ground bus shall be exothermic weld type.
   5. The “UFER” grounding electrode, embedded in concrete, shall be exothermically welded to each steel reinforcing bar (rebar) and each steel anchor bolt located within 18-inches of the grounding electrode inside the concrete. Note: Reinforcing steel (rebar), in concrete foundations, attached with metal “tie-wraps” and in direct physical contact to other adjacent

rebar that is in turn exothermic welded to the UFER grounding electrode, may be classified as attached to the UFER grounding electrode, and does not require additional exothermic weld connections to the UFER grounding electrode.

I. Provide a separate ground/bond insulated grounding electrode conductor, copper wire from the main electrical service ground bus to each of the following locations. The ground/bond conductor shall be sized to comply with applicable Codes and as indicated on the Drawings, but in no case smaller than the following:
   1. Main service entrance equipment ground bus:
      a. Services smaller than 1200 amp 1.5-inch conduit with 1#4/0.
      b. Services 1200 amp and larger 2.5-inches conduit with 1#500MCM.
      c. Where a separate ground bus is not required, connect ground to electrical equipment metal housing
   2. Each telephone backboard and signal system backboard location, 1.25-inch conduit with 1#1.
   3. Metal cold water pipe located inside the building, 1.5-inch conduit with 1#4/0.
   4. Outdoor underground metal cold water pipe, make connection five feet from the building, 1.5-inch conduit with 1#4/0.
   5. Each service entrance ground bus and each separately derived ground rod system:
      a. Services smaller than 1200 amp 1.5-inch conduit with 1#4/0.
      b. Services 1200 amp and larger 2.5-inches conduit with 1#500MCM.
   6. Separate 1.25 inch conduit with 1#2 (AWG) bonding conductor to each interior metal pipe system located in the same building, including but not limited to, the following:
      a. Fire sprinkler system each stand-pipe location (water based and non-water based).
      b. HVAC chilled water supply and return, at each pump location.
      c. Roof drains.
      d. Waste liquid disposal systems.
      e. Metal gas pipe service entrance and service meters.
      f. Hydraulic elevator hydraulic pipes.

3.3 CONDUIT

A. General
   1. The sizes of the conduits for the various circuits shall be as indicated on the Drawings, but not less than the conduit size required by Code for the size and quantity of conductors to be installed in the conduit.
   2. Conduits shall be installed concealed from view. Install conduits concealed in walls, concealed below floors and concealed above ceilings, except as specifically noted otherwise.
      a. Conduits shall not be installed in concrete floors.
   3. The following systems shall be considered as circuits 100 volts and less, all other circuits shall be considered to be over 100-volts (power circuits) unless specifically noted otherwise: Fire alarm, energy management control, telephone, public address, data, computer, television, intercom, intrusion alarm and nurse call.
   4. Conduits shall be provided complete with conduit bends, conduit fittings, outlet boxes, pullboxes, junction boxes, conduit anchors/supports, grounding/bonding for a complete and operating conductor/wire raceway system.
   5. Metal and nonmetal conduits shall be provided mechanically continuous between termination connection points. Metal conduit shall be provided electrically continuous between termination connection points.
   6. Individual conduit paths and home runs shown on the Drawings shall be maintained as separate individual conduits for each homerun and path.
   7. Conduits, conduit fittings and installation work occurring in classified hazardous materials locations shall comply with applicable Code Class 1 Division 1 requirements, unless specifically noted otherwise.
   8. Transitions between conduits constructed of different materials and occurring in above grade locations shall be allowed only at outlet boxes, junction boxes, pull boxes, and equipment enclosures unless specifically indicated otherwise. Provide outlet boxes and junction boxes.
   9. Metal conduit terminating to nonmetal enclosures; terminating into metal enclosures with “concentric ring” knockouts; terminating into metal enclosures with knockout reducing washers, including but not limited to equipment housings, outlet boxes, junction boxes, pull boxes, cable

trenches, manholes, shall be provided with a ground/bonding lug integrated with the conduit termination conductor fitting construction, by the Fitting Manufacturer. The lug shall provide for connection of a grounding/bonding conductor (insulated or uninsulated). The grounding lug shall be located on the fitting, inside the termination enclosure.

10. The type of conduit, type of conduit fittings, and type of conduit supports and method of conduit installation shall be suitable for the conditions of use and conditions of location of installation based on the Manufacturer's recommendations; based on the applicable Codes and based on the Requirements of the Contract Documents.

B. RMC Installation Locations

RGS, IMC conduits and RGS, IMC fittings shall be installed in the following locations:

1. Embedded in floors, walls, ceilings, roofs, foundations, and footings constructed with concrete.
2. Embedded in walls and foundations constructed with brick and masonry.
3. Interior of buildings, within 9-feet of finish floor lines for exposed conduit locations.
4. Exterior of building for exposed conduit locations.
5. Damp or wet locations, exposed or concealed locations.
6. Exposed on roofs.
7. In hazardous materials areas and locations; below hazardous materials areas and locations; above hazardous materials areas and locations.
8. Exposed on utility service poles, for pole risers less than 9-feet above finish grade.
9. RMC conduit and RMC fittings may be installed in any location where EMT and FMC conduit is permitted to be installed.

C. PVC Coated RMC Installation Locations

PVC coated RMC conduit and PVC coated RMC fittings shall be installed in the following locations:

1. Underground conduit locations for elbows and bends with a radius of less than 36-times the conduit diameter.
2. Underground vertical risers extending above grade.
3. Entire length of underground conduits for the following circuits:
   a. Audio microphones
   b. Lighting dimming controls
4. Installed in contact with earth or corrosive materials.
5. Exposed in "cold" rooms and "refrigerated" rooms, rooms with a maintained temperature below 65 degrees Fahrenheit.

D. EMT Installation Locations

EMT conduit and EMT fittings may be installed in the following locations, for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials"; only dry locations:

1. Concealed in hollow non masonry/non-concrete, metal stud frame and wood stud frame walls and floors.
2. Concealed above ceilings.
3. Exposed inside interior enclosed crawl spaces.
4. Exposed interior locations placed 9-feet or higher above finished floors (except as described in paragraph below at lower heights).
5. Exposed on walls and ceilings (any height) in the following dedicated function areas, interior enclosed room locations:
   a. Indoor enclosed electrical equipment rooms and closets.
   b. Indoor enclosed data and telecommunication terminal rooms and closets.
   c. Indoor enclosed HVAC equipment rooms and closets.
6. Any location where FMC is described to be installed, except as the final connection to rotating or vibrating equipment.

E. FMC Installation Locations

FMC conduit and FMC fittings may be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials"; only dry, interior locations:

1. Concealed in hollow non-masonry metal stud frame and wood stud frame fully enclosed walls.
2. Concealed above fully enclosed ceiling spaces.

3. FMC conduit shall be installed in continuous lengths between termination points. FMC shall not be “spliced” or coupled directly to FMC or any other conduit type under any circumstance.
4. The maximum continuous length of FMC that shall be installed between termination end points is 15-feet. Circuits requiring continuous conduit lengths exceeding 15 feet between termination end points shall be installed using either RMC or EMT conduits. FMC lengths shorter than 16-inches are prohibited.
5. The minimum size FMC conduit shall be as shown on the Drawings but not be less than the following:
   a. FMC lengths of 6-feet or less, minimum FMC conduit size shall be 0.50-inch.
   b. FMC lengths exceeding 6-feet, minimum FMC conduit size shall be 1.0-inch.

F. LTFMC Installation Locations

LTFMC conduit and LTFMC fittings shall be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only “non-hazardous materials”:

1. Final electrical connection to vibrating or rotating equipment; control and monitoring devices mounted on vibrating and rotating equipment including the following. Minimum conduit length shall not be less than 24-inches:
   a. Motor, engines, boilers, solenoids, and valves.
   b. Fixed mounted “shop” (manufacturing) production equipment.
   c. Fixed mounted food preparation equipment and “kitchen” equipment.
2. All locations where exposed flexible conduit connections are required, both indoor and outdoor.
3. Final connection to indoors electrical transformers. Minimum conduit length shall not be less than 24-inches; maximum conduit length shall not exceed 72-inches.
4. Do not install LTFMC located in environmental air plenums.

G. RNMC Installation Locations

RNMC conduit and RNMC fittings shall be installed in the following locations containing only “non-hazardous material”:

1. Underground, concealed below earth grade, unless specifically noted or specified otherwise.
2. Exposed on utility service poles, for pole risers at 9-feet or higher above finish grade, schedule 80 PVC only.
3. RNMC type “EB” conduit(s) shall be concrete encased along the entire length of the conduits for all installation locations.
4. Non-metal type raceways and RNMC type conduit shall not be installed inside buildings.

H. Combi-Duct Installation Locations

Combi-duct conduits shall be installed where shown on the Drawings. Combi-duct shall be installed underground (below grade) as follows:

1. Do not install exposed or inside buildings above grade.
2. Provide a 0.25-inch pull rope in each inner duct.
3. Radius and elbows shall be rigid non-metallic, PVC, Manufacturer factory fabricated, in lieu of PVC coated RMC conduit.
4. Inner ducts shall be supported by internal spacers inside the enclosing outer duct.
5. Provide end bell and three hole "snug-plugs" at each entrance end of Combi-duct into pullboxes, manholes, equipment cabinets stubups and Combi-duct terminations. Compression type “snug-plugs” shall provide watertight and airtight seal between inner and outer ducts and around future cables installed in inner duct.

I. Conduit Installation

1. Conduit Supports
   a. Securely and rigidly support all raceways/conduits from the building structure. Raceways/ Conduits shall be supported independent of all piping, air ducts, equipment ceiling hanger wires, and suspended ceiling grid systems. Secure conduit to structural element by means of UL listed and approved hangers, fasteners, “C” Channels and pipe clamps.
   b. Provide conduit supports spaced along the length of the conduit as follows:
      1) RMC and EMT conduit, maximum not to exceed 96-inches on center; within 24-inches of each conduit bend and conduit termination location.
      2) FMC and LTFMC conduit, maximum not to exceed 24-inches on center; within 6-inches of each conduit bend and conduit termination location.

c. Suspended conduit methods:
    1) Individual, suspended raceways/conduits separated by more than 12-inches from any other conduit and suspended from ceilings and roofs shall be supported as follows:
        a) Conduits smaller than 1.5-inches by means of hanger rods or hanger wires.
        b) Conduits 1.5-inches and larger by means of hanger rods.
        c) The conduit shall attach to the hangers with pipe clamps.
    2) Suspended raceways/conduits positioned within 24 inches of any other conduit shall be grouped and supported by hanger rods using trapeze type conduit support channels ("C" Channels). Conduits shall individually attach to common channels side-by-side, with pipe clamps.
d. Non-suspended conduit methods:
    1) Individual raceway/conduits placed against wall/ceiling/floors, placed inside hollow wall/ ceiling construction or structure framing (i.e., “dry- wall” or plaster hollow wall construction), shall be secured by means of individual pipe clamps and fasteners attached to the framing studs or other structural members and the conduit/raceway.
    2) Provide common “C" Channel supports for all multiple raceway/conduits placed against vertical or horizontal surfaces and positioned within 24-inches of other raceways/ conduits. Attach channels to the framing studs or other structural members. Attach the conduits/raceway individually to common channels, side-by-side, with pipe clamps.
    3) The use of toggle bolts is prohibited.
e. Conduit rising from floor for motor connection shall be independently supported if extending over 18-inch above floor. Support shall not be to a motor or ductwork, which may transmit vibrations.
f. Provide conduit anchoring, conduit support and conduit bracing systems conforming to Earthquake Seismic Zone 4 requirements. The conduit support/anchoring system capacity shall include the weight of the conduits, conduit fittings, conduit supports and conductors/ wires/cables installed in the conduits plus a 300% safety factor. Submit Shop-Drawing details showing each typical conduit anchor, conduit support and conduit brace location. Submit structural calculations performed by and signed by a Professional Structural Engineer (P.E.) with a P.E. License, Registered in the State of California, U.S.A.

2. Conduit separation:
    a. Conduit installed underground or below building slab without full concrete encasement: Shall be separated from adjacent conduits of identical systems (i.e. signal to signal, data to data, power to power, control to control etc.) by a minimum of 3-inches. Conduits of non-identical systems (i.e. signal to power; data to power; power to control; signal to control, etc.) shall be separated by a minimum of 12-inches.
    b. Conduit installed underground with full concrete encasement; shall be separated from adjacent conduits of similar systems (100 volt and less) by a minimum of 2-inches; conduits for non-power systems (100 volts and less to ground) shall be separated by a minimum of 6-inches from power circuits (over 100 volts to ground); conduits for power circuits shall be separated from adjacent conduits of similar power systems (over 100 volts to ground) by a minimum of 3-inches.
    c. Separation of conduits entering termination points or crossing other conduits may be reduced as required within 60-inches of the termination or crossing points.
    d. Conduits containing Utility Company service circuits (i.e. electrical power, telephone, or cable television) shall be separated a minimum of 12-inches from all other utilities and conduits, with or without concrete encasement; metallic or non-metallic conduit, above grade or underground conduit locations.
    e. Conduits shall be separated from hot water piping, exhaust flues/chimneys, steam piping, boilers, furnaces, ovens by a minimum of 12-inches.
3. Conduit stubs:
    a. Branch circuit and telephone conduits turned up from floor at the following locations shall terminate each conduit in a flush conduit coupling at the floor and then extend into partition or to equipment. Refer to District’s Representative’s Drawings for location of walls and partitions.
        1) Interior demountable partitions.
        2) Below, into or adjacent to equipment not installed directly adjoining to a wall.
        3) Up from below the floor into hollow stud frame walls.

b. From each panel, and signal cabinet which is wall mounted, stub up from top of the panel/ cabinet a minimum of three 1-inch conduits to the nearest accessible ceiling spaces or other accessible location. Where the floor below the panel is accessible or is a ceiling space, stub an additional three 1-inch conduits from the bottom of the panel into the accessible space below the panel. Cap conduits for future use.
c. Conduits stubbed underground outside of building line for future use shall be terminated a minimum of five feet clear (whichever distance is greater) of building or adjacent concrete walks and AC paving. The stubout conduit shall be capped. Provide concrete monuments, 6-inches by 6-inches by 15-inches deep, buried flush with grade over the capped ends. The face of monument shall be furnished with 3-inch square brass plates securely mounted and engraved with the number and size of conduits and type of service (i.e., "POWER", "TEL.", etc.).
d. Conduits stubbed into ceiling or floor spaces from outlets for telephone, video, computer/ data or television shall be provided with an insulated throat bushing, on the end of each conduit stubout.
e. Conduit stubouts from outlet boxes and equipment located in hollow stud walls, into ceiling and floor spaces, shall be EMT or RMC conduit. The stubouts shall terminate into the ceiling and floor spaces with a conduit termination connector fitting.
f. Empty conduit stubs into building spaces and equipment shall be individually identified with an “ID-tag” located at each end of the conduit. The ID-tag shall state the origination point and termination point of the respective conduit (i.e., “from PNL-A/to Room #121”; “from outlet #24/to outlet #17 in Room #120”; etc.).
g. Provide a conduit termination fitting with insulated throat bushing and mechanical ground lugs at each conduit “stub-up” location.

4. Conduit concrete encasement:
   a. Conduits which are run underground exterior to building slab shall be continuously concrete encased except, 15 and 20-amp power branch circuit conduits underground do not require concrete encasement.
   b. PVC rigid-non-metallic-type EB conduit, of any size and any location shall be continuously concrete encased the full length of the conduit installation, including under building slab.
   c. Concrete for encasement of underground conduits shall be 2000-PSI 28-days cure strength with a mix of cement, sand, water and maximum of ¾-inch gravel. Concrete encasement of conduits shall be continuous without voids. The encasement shall extend 3-inches past the edges of all conduits on all sides of the circuit. Provide 10-pounds of red oxide cement coloring uniformly mixed with each cubic yard of concrete for conduit encasement.
   d. Conduits located below or adjacent to structural foundations shall be separated from the foundation by a minimum of 12-inches. Conduits located below structural foundations shall be fully and continuously concrete backfilled and encased between the bottom of the foundation to the bottom of the conduits. The concrete shall be 4000 PSI 28 day cure strength instead of 2000-PSI concrete.
   e. Conduits of any size and type (including 15 amp and 20 amp power branch circuits) located under roads, paved areas and “transit-system” right of way shall be concrete encased.
5. Underground conduits:
   a. Three or more underground conduits larger than 1-inch in size and occupying the same trench shall be separated and supported on factory fabricated, non-metallic, duct/conduit support spacers. The spacers shall be modular, keyed interlocking type, "built-up" to accommodate quantity, size orientation and spacing of installed conduits.
      The spacers shall maintain a constant distance between adjacent conduit supports and hold conduits in place during trench backfill operations. Minimum support spacer installation interval along with length of the conduits shall be as follows:
      1) Concrete encased conduits, not less than 8-feet on center.
      2) Non-concrete encased conduits, not less than 5-feet on center.
   b. Provide trenching, excavation, shoring and Backfilling required for the proper installation of underground conduits. Tops of backfill shall match finish grade.
   c. Bottoms of trenches shall be cut parallel to “finish grade” elevation. Make trenches 12-inches wider than the greatest diameter of the conduit.
   d. Back-filling Trenches for Conduits without Concrete Encasement Requirements
      1) Conduits which are not required by the Contract Documents to be concrete encased and are located exterior to building slab, shall be set on a 3-inch bed of damp clean

sand. Conduit trenches shall be backfilled to within 12-inches of finished grade with damp sand after installation of conduit is completed. Remainder of backfill shall be native soil.

2) Conduits located under a building which are not required by the Contract Documents to be concrete encased, shall be completely backfilled and compacted with clean damp sand to the same level as the building foundation pad.
3) Provide a continuous yellow 12-inches wide flat plastic tracer tape, located 12-inches above the conduits in the trench. The tracer tape shall be imprinted with "Warning-Electric Circuits" a minimum of 24-inches on center.

e. Backfilling trenches for conduits under paved areas:
   1) In addition to the requirements of conduit concrete encasement, conduits under walkways, roads, parking lots, driveways, and buildings shall be cast in place concrete "slurry mix" backfill. The slurry mix shall cover each side and top of conduits and conduit concrete encasement. The slurry mix shall be continuous to the underside of the finish subgrade surface.
f. Backfilling trenches for conduits with concrete encasement requirements by the Contract Documents:
   1) Trenches with all conduits concrete encased shall be backfilled with clean damp sand when located under building pads.
   2) Trenches with all conduits concrete encased and not located under a building pad and not located under paved areas shall be backfilled with clean damp sand or native soil.
g. Backfill material:
   1) Sand and native soil backfill of trenches shall be machine vibrated in 6-inch lifts to provide not less than 90% compaction of backfill.
   2) Soil backfill shall have no stones, organic matter of aggregate greater than 3-inches.
   3) Concrete and slurry mix (2000-PSI) shall be machine vibrated during installation to remove "air-voids".
   4) The slurry mix shall consist of concrete, clean rock, clean sand and clean water mixture. Maximum shrinking of slurry mix shall not exceed 5% wet to dry.
h. Do not backfill until District's Representative has approved Installation and As-built Drawings are up to date. Promptly install conduits after excavation has been done, so as to keep the excavations open as short a time as possible. Excess soil from trenching shall be removed from the site.
i. Install underground conduit, except under buildings, not less than 24-inches below finished grade in non-traffic areas and 30-inches below finished grade in traffic areas, including roads and parking areas. Not less than 48-inches below finished grade under public/ private transit system right of way and railroad right of way. Dimensions shall be measured to the top of the conduit.
j. Conduit crossing existing underground utilities shall cross below the bottom depth of the existing utilities. If the top portion of the existing utility depth below finish grade exceeds 72-inches and the specified separation and depths are maintained when crossing over the top of the existing underground utility, the conduit may cross above the existing underground utility.
k. Provide long radius horizontal bends (minimum radius of 36-times the conduit diameter) in underground conduits where the conduit is in excess of 100-feet long.
l. Conduits installed below grade and on grade below buildings, shall not be smaller than 0.75-inches. Conduits for circuits exceeding 600-volts shall not be smaller than 5.0-inches.
m. Underground conduits entering a building shall be sloped. The conduit direction of slope shall be away from the building, and shall prevent water in the conduit from "gravity draining" towards the building. The conduit slope "high point" shall originate from the building, out to the first exterior pullbox, manhole etc. exterior conduit termination "low point". The minimum slope angle shall be a constant 8-inches (or greater) of fall for each 100-feet of conduit length.
n. Dewatering:
   1) Provide pumping to remove, maintain and dispose of all water entering the excavation during the time the excavation is being prepared, for the conduit laying, during the laying of the conduit, and until the backfill at the conduit zone has been completed. These provisions shall apply on a continuous basis. Water shall be disposed of in a manner to prevent damage to adjacent property. Trench water shall not be drained

through the construction. Groundwater shall not be allowed to rise around the pipe until joining compound has firmly set.
2) The District's Representative shall be notified 48 hours prior to commencement of dewatering.

6. Raceway/Conduits, which are installed at this time and left empty for future use, shall have 0.25-inch diameter polyvinyl rope left in place for future use. The pull rope shall be 500-pound minimum tensile strength. Provide a minimum of 5-feet of slack at each end of pull ropes.
7. Unless otherwise restricted by Structural Drawings and Specifications, the maximum size conduit permitted in concrete slab on-grade, walls, ceilings and roofs constructed of masonry or concrete shall not be greater than 20% of the concrete/masonry thickness. Conduits installed in these locations shall not cross.
   a. Conduits shall not be installed in cast-in-place concrete floors.
8. Provide openings in building structures for conduit penetrations:
   a. New construction shall be provided with conduit sleeves, to provide conduit penetrations.
   b. Existing construction shall be drilled (core drill masonry and concrete) and provide conduit sleeves installed after drilling, to provide conduit penetrations.
   c. Where the structure penetrations for underground conduits penetrating through foundations will not comply with the (restriction/penetration) shown in the Contract Documents, install the conduits below and clear of the foundation lowest point.
9. Conduit bends risers and offsets:
   a. The minimum bend radius of "factory or field" fabricated conduit bends shall not be less than the following. The bend radius shall be measured at the surface, inside radius of the conduit wall:
      1) FMC and LTFMC conduit - conduit minimum bend radius 12-times the conduit diameter.
      2) RMC and EMT conduit minimum bend radius - conduit for power circuits over 100 volts and less than 600 volts, 8-times conduit diameter. Conduit for power circuits over 600 volt, 12-times conduit diameter. Conduit for low voltage, signal and fiber optic circuits, 10-times conduit diameter.
      3) RNMC conduit - conduit minimum bend radius 36-times the conduit diameter. Under building reduce minimum bend radius to 10-times the conduit diameter. Conduit bends and offsets in RNMC with less than 36-times conduit diameter bend/offset radius shall be RNMC PVC schedule 80 or PVC coated RGS.
      4) Conduits for Utility Company conductors. Conduit minimum bend radius shall comply with the respective Utility Company requirements.
   b. Bends and offsets in conduits shall be kept to an absolute minimum. The total summation of all bends and offsets permitted in a conduit segment, occurring between two conduit termination/connection end points, shall not exceed the following, including conduit fittings:
      1) RMC and EMT conduit - 360 angular degrees
      2) FMC and LTFMC conduit - 180 angular degrees
      3) RNMC conduit - 270 angular degrees
   c. Each field fabricated conduit offset, bend and elbow which are not the standard product of the Raceway/Conduit Manufacturer shall be mandrel tested. The test shall be conducted after the conduit installation is complete and prior to pulling-in any wire, in the same manner as for underground conduits.
   d. Factory manufactured angle connector conduit fittings shall be installed in exposed conduit locations only. Installation in locations normally concealed from view shall not be permitted. Not more than one factory manufactured angle connector shall be permitted in any length of conduit between conduit termination end points.
   e. RNMC conduit risers from below grade shall be PVC coated RGS. Conduit risers, bends or offsets entering into a building shall be PVC coated RGS.
   f. If three or more conduit-bends of the same conduit size and same conduit material type, installed, as part of the Contract Work, fail to comply with the required minimum conduit bend radius or conduit angular degree limits. The following corrective actions shall occur:
      1) The Contractor shall remove all the non-complying conduit bends and the respective wire in the conduit from the project site. Provide new conduit and wire, complying with the Contract Documents.

2) Where the conduit bends similar to the non-complying conduit bends are installed concealed in walls, floors, above ceilings or below grade, the Contractor shall expose the conduit bends to allow visual observation.
3) The Contractor shall remove the non-complying conduit bends and dispose of the Project Site. The Contractor shall provide new conduit bends and conductors complying with the Contract Documents.
4) All the costs to correct the deficient material and work along with costs to repair the direct, indirect, incidental damages and Contract delays shall be the sole responsibility of the Contractor and shall be included in the bid price.

10. Expansion joint, deflection joint and seismic joint fittings.
    a. Provide a conduit expansion fitting for each conduit length and conduit type as follows (Note - The installation of specified combination expansion/ deflection fittings at seismic joints shall satisfy this spacing requirement also):

	Conduit Type	Conduit	Fitting Length Spacing
1)	RMC and EMT	Exposed exterior locations	200-feet
2)	RMC and EMT	Interior weather protected locations	100 feet

    b. Provide a conduit combination expansion/deflection fitting for each conduit, crossing the following elements:
        1) At each building or non-building structure seismic joint.
        2) At each building on non-building structure expansion joint.
        3) At each conduit penetration of a “sound-rated” wall, floor or ceiling.
11. Provide two locknuts and an insulated throat bushing at each metal conduit terminating at enclosures, including but not limited to outlet boxes, junction boxes, terminal cabinets, switchgear, transformers, switchboards, distribution panels and panelboards.
12. Provide metallic or plastic closure caps on all conduit ends during construction, until installation of conductors in the respective conduit.
13. Conduit run exposed, shall be run at right angles or parallel to the walls or structures. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds, OZ or equal. Conduits run on exposed beams or trelliswork shall be painted to match surrounding surfaces.
14. Conduit exposed on roof:
    a. Conduits installed exposed on roofs shall be installed on conduit sleepers. Place the conduit sleepers a maximum 5-foot on center along the entire length of the conduit; under conduit expansion/deflection fittings; under each junction box and within 24-inches of each conduit bend.
    b. Provide a conduit support “C” Channel continuous along the top length of the sleeper and rigidly bolted to the sleeper. Conduits shall be loosely fastened to each sleeper “C” Channel with pipe clamps to allow for relative movement between the sleeper and conduit.
    c. Conduits shall not block or interfere with roof hatches, doors, ventilation openings, dampers, equipment access panels/doors, roof water drainage.
    e. Conduit sleepers shall be fabricated from “clear” solid redwood 4-inches by 4-inches (nominal) size. Sleeper length shall extend a minimum of 9-inches past the conduits attached to the sleeper, but in no case shall the length of the sleeper be less than 24-inches.
    f. Provide a pad under each sleeper; sleepers shall not be installed in direct contact with the roofing. Sleeper pads shall extend a minimum of 6 inches past each side of the sleeper. The sleeper pad shall be semi-rigid mineral surfaced composition board, not less than 0.375-inch thickness, bituminous impregnated, manufactured for application on the specific roofing material. Remove roofing “ballast” (gravel) under pad, prior to installation of sleeper pad. Do not puncture roof membrane.
    g. Position the “length” of the conduit sleepers’ perpendicular to the roof slope, to prevent obstruction of roof drainage water flow. Where the conduit routing prevents placing the conduit sleeper parallel to the roof slope, provide two separate sleeper pads for the conduit sleeper, with a continuous 3-inches wide water drainage gap between the sleepers. Align the water drainage gap to allow unimpeded water travel along the roof slope drainage flow line between the pads.
    h. Sleepers and sleeper pads shall be set in nonhardening mastic, a minimum of 0.25-inch thickness. Mastic shall be inorganic, nonhardening, and complying with ASTM-D1227. Mastic shall be applied with continuous uniform coverage, minimum 0.25-inch thickness, on

all the surfaces of each conduit sleeper and on the sleeper pad contact surface with the roof.

15. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.
16. RMC conduit threads:
    a. Machine cut threads on RMC conduit required for field fabrication shall comply with NPS and ANSI-B1.20.1.
    b. The length of bare metal exposed during thread fabrication shall be completely covered by conduit couplings and fittings. Additionally, the thread length shall insure that conduit joints will reach "torque" tightness and become secure before conduit ends "butt" together and before conduit ends "butt" into the "shoulders" of other conduit fittings.
    c. Running threads or right/left handed threads shall not be used to connect RMC.
17. RNMC conduit:
    a. Joints and fittings shall be solvent welded to RNMC conduit. Joints and fittings shall be watertight and airtight after fabrication.
18. Tighten each conduit fittings and fitting appurtenance, to the "torque" (allowable tolerance ±5%) value recommended by the Fitting Manufacturer and applicable code. If three or more conduit fittings are found to not be in compliance with the Manufacturer's "torque" (tightness) recommendations, the following corrective actions shall occur:
    a. The Contractor shall tighten "re-torque" the defective fittings and all similar conduit fittings installed as part of the Contract Documents in the presence of the District's Representative.
    b. If the respective conduit fittings similar to the deficient "torque tightness" fittings are installed concealed in walls, floors, above ceilings or below grade, the Contractor shall expose the fitting, to allow retightening each similar conduit fitting to the Manufacturers recommended "torque" values.
    c. All the cost to repair the direct, indirect, incidental damages and Contract delays resulting from complying with these requirements shall be the sole responsibility of the Contractor and shall be included in the bid price.
19. Horizontal directional boring for underground conduit:
    a. Provide a directional guided horizontal "bore-hole" underground conduit installation where one or more of the following conduits occur:
        1) Continuous trenching excavation and backfill for conduit installation is not permitted by the Contract.
        2) Where continuous trenching excavation due to the existing surface and below grade conditions and restrictions, is not possible or practical to excavate a trench.
    b. Provide "path-tracing" of the underground bore head, from the surface, along the entire horizontal bore length. Path tracing shall use electronic transmitters and receivers, continuously communicating the underground bore head locations and depth to the bore equipment operator. The directional boring system shall employ active tracking and directional position/steering control of the bore equipment drill head location. The active tracking system shall provide a portable receiver/transmitter unit for tracking the position of the moving drill head; a sensor "Sonde" unit on the drill head for tracking signals to the receiver/transmitter; and a drill head tracking data view display located at the boring equipment operator position to view the drill head position information sent from the portable receiver/transmitter. As manufactured by SPX-Radiodetection Company or similar products.
    c. Provide vertical pilot excavations not more than 50-feet on center along the path of the bore-hole to intercept the horizontal bore-hole routing, provide excavations at the beginning and end terminals staging points of the horizontal bore-hole.
    d. Provide full-depth "shoring" of the vertical pilot excavations. Remove the shoring, backfill, compact and repair the excavations when conduit installation is complete.
    e. "Drilling-fluid" shall be used during "back-reaming" and "pullback", pumped through the drill pipe to the bore drill head.
    f. Directional guided horizontal drilling shall employ equipment specifically designed and manufactured for the process. The Equipment Manufacturer shall train bore equipment operating personal in the proper operation of said equipment.
    g. Locate the position, size, depth and identify all underground "cross-bore" existing underground utilities, pipes, structures and conflicts along the entire bore path of each

underground bore, prior to initiating directional boring work. Notify respective agency for each “cross bore” potential crossing. Comply with the recommendations of the Cross Bore Safety Association (CBSA).

h. Horizontal, directionally guided boring equipment, as manufactured by Ditch Witch; Vermeer Manufacturing; or Case Corporation.

J. Conduit Seals

1. Provide conduit seal fittings at each location where a conduit transitions or passes through the following areas and where indicated on the Drawings:
   a. Refrigerated areas.
   b. Temperature control rooms including warming rooms, steam rooms, saunas etc.
   c. Classified hazardous material areas.
   d. Water intrusion areas.
2. Provide conduit seals on each conduit entering a building from a below grade area located outside the building (i.e., basement, vault etc.) and connecting to the following types of equipment
   a. Transformers
   b. Panelboards
   c. Motor control centers
   d. Switchboards
   e. Switchgear
   f. Motors
   g. Terminal cabinets
   h. Terminal backboards
   i. Cable trenches
3. Conduit seals shall be installed in locations where the fitting is visible and accessible.

K. Nailing Shields

1. Provide “nail” shields where FMC conduit and conductors not installed in a conduit are installed through wood stud and wood frame construction. The nail shield shall provide a barrier resistant to “nailing” fasteners through the stud, and penetrating into the FMC and conductors.
2. The nail shields shall be flat nominal 1.5-inch by 3-inches, 14-gauge steel, and hot dip zinc galvanized with “nailing spurs”.
3. Provide nailing shields on the front face and rear face of each FMC penetration. The shield shall be centered on each penetration through the respective framing, stud framing blocking, and stud framing plates.

L. Conduit Bodies

1. Conduit bodies shall be installed in exposed conduit locations only or above accessible ceilings.
2. Conduit bodies shall be accessible for removing body cover and pulling wire through the conduit body.
3. Conduit bodies shall not be installed inside enclosed walls.

M. Preparation of Reuse of Existing Conduits

1. Prepare existing conduits shown to be reused as part of Contract Work as follows: Complete the required work prior to installing any conductors or cables in respective existing conduits.
   a. “Rod” out existing raceways to be used under this contact, with approved test and flexible mandrels to remove all obstructions to clear debris from inside conduits.
   b. Use test mandrels at least 12-inches long, 0.25-inch less than diameter of duct at center, tapering to 0.5-inch less than duct size at ends.
2. If test mandrels cannot be pulled through raceways, Contractor shall perform the following to clear the existing raceways:
   a. Force rigid or semi-rigid rods through the raceways to clear the obstructions from one to both ends of the raceway.
   b. Force a power driven rotating router device through the conduit from one or both ends of raceways. Device shall incorporate small diameter cutting blades. Repeat the “router” process in incremental stages to a cutting blade diameter approximately ⅛-inch smaller than the raceway inside diameter.

3. After clearing the raceway of obstructions, pull a test mandrel or brush through the raceway to clear the remaining debris from the raceway.

3.4 WIRE AND CABLE

A. Branch Circuit and Fixture Joints for #10AWG and smaller wire shall be made with UL-approved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and two (2) wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by 3M-"Scotchlok".

B. Branch Circuit Joints of #8AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, tapered half-lapped and at least the thickness equivalent to 1.5-times the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.

C. Use UL listed pulling compound for installation of conductors in conduits.

D. Correspond each circuit to the branch number indicated on the panel schedule shown on the Drawings except where departures are approved by the District's Representative.

E. All Wiring, including low voltage, shall be installed in conduit.

F. Control Wiring to conform to the wiring diagrams shown on the Mechanical Drawings and the Manufacturer's Wiring Diagrams.

G. All Splices in exterior pull boxes and light poles shall be cast resins encapsulated.
   1. Power conductor splices - 3M Scotchcast Series 82/85/90; Plymouth or equal.
   2. Control and signal circuits 3M Scotchcast Series 8981 through 8986, Plymouth or equal.

H. Neatly Group and Lace all wiring in panelboards, motor control centers and terminal cabinets with plastic ties at 3-inch on centers. Tag all spare conductors.

3.5 CHEMICAL GROUND ROD

A. General
   1. Install ground rod system in compliance with Manufacturer's instructions.
   2. Install rods vertically. Where subterranean hard rock conditions prevent vertical installation horizontal "L" shape ground rod shall be installed.
   3. Where ground rod is installed in an indoors dry location set ground box flush with finish floor. Where ground rod is installed outdoors set the top of the ground box four inches above finish grade.
   4. Do not remove sealing tape from ground rod holes until time of installation in ground.
   5. Separate ground rods from all other grounding electrodes and from each other by not less than 12-feet horizontal distance.

B. Excavation
   1. Vertical installation bore a 12-inches diameter vertical hole in the ground 6-inches deeper than ground rod length.
   2. Horizontal installations excavate a 12-inches wide trench, slope rod and trench to insure end cap of rod is 2-inches lower than the elbow.

C. Backfill
   1. Surround the entire rod with a minimum of 10 inches of bentonite clay mixed with water at six times volume to form a paste. Approximately 14-gallons for each 50-pounds of clay. Remove any excavation liners from the rod excavation area.
   2. Install ground box and complete backfill.

D. Connect grounding electrode conductor(s) to ground rod.

3.6 CABLE RACKS

A. General

1. Provide cable racks in precast and cast-in place concrete pullboxes, manholes and cable trenches.

3.7 TESTING

A. Testing Conduit and Conduit Bends

The Contractor shall demonstrate the usability of all underground raceways, and field fabricated conduit bends installed as part of this Contract.

1. A round tapered segmented semi-rigid mandrel with a diameter approximately ¼-inch smaller than the diameter of the raceway, shall be pulled through each new raceway.
2. The mandrel shall be pulled through after the raceway installation is completed. Conduits which stubout only, may have the mandrel pulled after the concrete encasement is completed, but prior to completing the backfill.
3. District's Representative shall witness the raceway testing for usability. A Representative of the respective Utility Company shall witness the raceway testing where applicable.
4. Contractor shall repair/replace any conduit and conduit bend provided under this Contract which will not readily pass the mandrel during this test.

B. Refer to Section 260500 Common Work Results for Electrical item 1.13 for Testing requirements.

END OF SECTION 260530

091517/1010006

SECTION 260943
LIGHTING CONTROLS SYSTEM

Revised, Addendum #3, 09/22/2017

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Digital-Network Lighting Control System and Associated Components (See Section 09113 for General Commissioning requirements):
   1. Power panels.
   2. LED drivers.
   3. Lighting control modules (Lutron Energi Savr Node).
   4. Lighting management hubs.
   5. Lighting management system computers.
   6. Lighting management system software.
   7. Control stations.
   8. Low-voltage control interfaces.
   9. Wired sensors.
   10. Wireless sensors.
   11. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 265113 - Luminaires, Ballasts, and Drivers - Lutron.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; Code of Federal Regulations; current edition.

B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements.

C. ANSI/ESD S20.20 - Standard for the Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

D. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments

E. CAL TITLE 24 P6 - California Code of Regulations, Title 24, Part 6 (California Energy Code).

F. IEC 60669-2-1 - Switches for Household and Similar Fixed Electrical Installations - Part 2-1: Particular Requirements - Electronic Switches.

G. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements.

H. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test.

I. IEC 61000-4-5 - Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques - Surge Immunity Test.

J. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.

K. ISO 9001 - Quality Management Systems-Requirements.

L. NECA 1 - Standard for Good Workmanship in Electrical Construction.

M. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association.

N. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association.

O. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association.

P. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

R. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

S. UL 508 - Industrial Control Equipment; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

T. UL 508A - Industrial Control Panels; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

U. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

V. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

W. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

X. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other Sections or by others.
   2. Coordinate the placement of wall controls with actual installed door swings.
   3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other Sections or by others.
   4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
   5. Notify Architect of any conflicts or deviations from the Contract Documents to obtain direction prior to proceeding with work.

B. Pre-Wire Meeting: Conduct on-site meeting with Lighting Control System Manufacturer prior to commencing work as part of Manufacturer's standard startup services. Manufacturer to review with Installer:
   1. Low voltage wiring requirements.
   2. Separation of power and low voltage/data wiring.
   3. Wire labeling.
   4. Lighting management hub locations and installation.
   5. Control locations.
   6. Computer jack locations.
   7. Load circuit wiring.
   8. Network wiring requirements.

9. Connections to other equipment and other Lutron equipment.
10. Installer responsibilities.
11. Power panel locations.

C. Sequencing:
1. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.

C. Shop Drawings:
1. Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
2. Provide detailed sequence of operations describing system functions.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by Product Testing Agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Title 24 Acceptance Testing Documentation: Submit Certification of Acceptance and associated documentation for lighting control acceptance testing performed in accordance with CAL TITLE 24 P6, as specified in Part 3 under "COMMISSIONING".

F. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

G. Warranty: Submit Sample of Manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final execution completed in Owner's name and registered with Manufacturer.

1.6 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70.

B. Maintain at the Project Site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications:
1. Company with not less than 10-years of experience manufacturing lighting control systems of similar complexity to specified system.
2. Registered to ISO 9001, including in-house engineering for product design activities.
3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

D. Title 24 Acceptance Testing Technician Qualifications: Certified by a California approved Acceptance Test Technician Certification Provider (ATTCP) as an Acceptance Test Technicians (ATTs) in accordance with CAL TITLE 24 P6.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store Products in a clean, dry space in original Manufacturer's packaging in accordance with Manufacturer's written instructions until ready for installation.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional Warranty requirements.

B. Manufacturer's Standard Warranty, with Manufacturer Start-Up; Lutron Standard 2-year Warranty; Lutron LSC-B2:
   1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:
      a. First Two Years:
         1) 100% replacement parts coverage, 100% Manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
         2) First-available on-site or remote response time.
         3) Remote diagnostics for applicable systems.
      b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding Manufacturer holidays.
   2. Lighting Management System Computer: One year 100% parts coverage, 1-year 100% Manufacturer labor coverage.
   3. Ballasts/Drivers and Ballast Modules: 5-years 100% parts coverage, no Manufacturer labor coverage.

C. Include as part of the base bid additional costs for Manufacturer's Enhanced Warranty with Manufacturer Start-up; Silver Enhanced Warranty; Lutron LSC-E8S; coverage to include items listed under Manufacturer's standard warranty with Manufacturer start-up above, plus the following upgrades:
   1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:
      a. First Two Years:
         ~~1) As-available Field Service response; no committed response time.~~ ***ADD 3***
      b. Additional Coverage for year's 3-5: 50% replacement parts coverage, no Manufacturer labor coverage.
      c. Additional Coverage for year's 6-8: 25% replacement parts coverage, no Manufacturer labor coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Lutron Electronics Company, Inc.; www.lutron.com.

B. Substitutions: See Section 016000 - Product Requirements.
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect a minimum of 10 working days prior to the bid date and must be made available to all Bidders. Proposed substitutes must be accompanied by a review of the Specification noting compliance on a line-by-line basis.
   2. By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete Engineered Shop Drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.

2.2 DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

A. Sensor Layout and Tuning: No Lighting Control Manufacturer Sensor Layout and Tuning service to be provided; Lutron LSC-NO-SENS-LT.
   1. Contractor to utilize Lighting Control Manufacturer Installation Instructions to place/install sensors.
   2. At Pre-wire and Startup, Lighting Control Manufacturer to provide a rough sensor calibration only. Sensor fine-tuning to be the responsibility of Contractor.

B. Provide Products Listed, Classified, and Labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

C. Unless Specifically Indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

D. Design Lighting Control Equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90% non-condensing relative humidity.

E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

F. Dimming and Switching (Relay) Equipment:
   1. Designed so that electrolytic capacitors operate at least 36 degrees F (20 degrees C) below the capacitor's maximum temperature rating when the device is under fully loaded conditions at maximum rated temperature.
   2. Inrush Tolerance:
      a. Utilize load-handling thyristors (SCRs and triacs), field effect transistors (FETs) and isolated gate bipolar transistors (IGBTs) with maximum current rating at least two times the rated operating current of the dimmer/relay.
      b. Capable of withstanding repetitive inrush current of 50 times the operating current without impacting lifetime of the dimmer/relay.
   3. Surge Tolerance:
      a. Panels: Designed and tested to withstand surges of 6,000 V, 3,000 amps according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance.
      b. Other Power Handling Devices: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
   4. Power Failure Recovery: When power is interrupted and subsequently restored, within 3 seconds lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
   5. Dimming Requirements:
      a. Line Noise Tolerance: Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2% change in RMS voltage per cycle), frequency shifts (plus or minus 2Hz change in frequency per second), dynamic harmonics, and line noise.
         1) Systems not providing integral cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.
      b. Incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.
      c. Utilize air gap off to disconnect the load from line supply.
      d. Control all light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.
      e. Load Types:
         1) Assign a load type to each dimmer that will provide a proper dimming curve for the specific light source to be controlled.
         2) Provide capability of being field-configured to have load types assigned per circuit.
      f. Minimum and Maximum Light Levels: User adjustable on a circuit-by-circuit basis.
      g. Line Voltage Dimmers:
         1) Dimmers for Magnetic Low Voltage (MLV) Transformers:
            a) Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
            b) Dimmers using unipolar load current devices (such as FETs or SCRs) to include DC current protection in the event of a single device failure.
         2) Dimmers for Electronic Low Voltage (ELV) Transformers: Operate transformers via reverse phase control. Alternately, forward phase control dimming may be used if Dimming Equipment Manufacturer has recommended specific ELV transformers being provided.
         3) Dimmers for Neon and Cold Cathode Transformers:
            a) Magnetic Transformers: Listed for use with normal (low) power factor magnetic transformers.

b) Electronic Transformers: Must be supported by the Ballast Equipment Manufacturer for control of specific ballasts being provided.

h. Low Voltage Dimming Modules:
1) Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to a single zone.
2) Single low voltage dimming module; capable of controlling the following light sources:
a) 0-10V analog voltage signal.
• Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
• Sink current according to IEC 60929.
• Source current.
b) 10-0V reverse analog voltage signal.
c) DSI digital communication.
d) DALI broadcast communication per IEC 60929:
• Logarithmic intensity values complying with IEC 60929.
• Linear intensity values for use with LED color intensity control.
e) PWM per IEC 60929.

6. Switching Requirements:
a. Rated Life of Relays: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
b. Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
c. Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

G. Device Finishes:
1. Standard Colors: Comply with NEMA WD1 where applicable.
2. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
3. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.3 POWER PANELS

A. Provide power panels with configurations as indicated on the Drawings.

B. General Requirements:
1. Listed to UL 508 as industrial control equipment.
2. Comply with UL 508A and IEC 60669-2-1 as applicable.
3. Delivered and installed as a listed factory-assembled panel.
4. Field wiring accessible from front of panel without removing dimmer assemblies or other components.
5. Passively cooled via free-convection, unaided by fans or other means.
6. Shipped with each dimmer in mechanical bypass position by means of jumper bar inserted between input and load terminals. Jumpers to carry full rated load current and be reusable at any time. Mechanical bypass device to allow for switching operation of connected load with dimmer removed by means of circuit breaker.
7. Provided with branch circuit protection for each input circuit unless the panel is a dedicated feed-through type panel or otherwise indicated on the Drawings.
8. Branch Circuit Breakers:
a. Listed to UL 489 as molded case circuit breaker for use on lighting circuits.
b. Provided with visual trip indicator.
c. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
d. Thermal-magnetic construction for overload, short-circuit, and over-temperature protection. Use of breakers without thermal protection requires dimmers/relays to have integral thermal protection to prevent failures when overloaded or ambient temperature is above rating of panel.
e. Equipped with provision for tag-out/lock-out devices to secure circuit breakers in off position when servicing loads.
f. Replaceable without moving or replacing dimmer/relay assemblies or other panel components.
g. Listed as Switch Duty (SWD) so that loads can be switched on and off by breakers.

9. Provide panels with listed short circuit current rating not less than the available fault current at the installed location as indicated on the Drawings.
10. Panel Processor; Lutron Circuit Selector:
    a. Provide the following capabilities:
        1) Operate circuit directly from panel processor for system diagnostics and provide feedback of system operation.
        2) Electronically assign each circuit to any zone in lighting control system.
        3) Determine normal/emergency function of panel and set emergency lighting levels.
    b. React to changes from control within 20 milliseconds.
11. Diagnostics and Service:
    a. Replacing dimmer/relay does not require re-programming of system or processor.
    b. Include diagnostic LEDs for dimmers/relays to verify proper operation and assist in system troubleshooting.
    c. Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant.
        1) If lighting control system fails, lights to remain at current level. Panel processor provides local control of lights until system is repaired.
        2) If panel processor fails, lights to remain at current level. Circuit breakers can be used to turn lights off or to full light output, allowing non-dim control of lights until panel processor is repaired.
        3) If dimmer fails, factory-installed mechanical bypass jumpers to allow each dimmer to be mechanically bypassed. Mechanical bypass device to allow for switching operation of connected load with dimmer removed by means of circuit breaker.

C. Product(s):
1. Relay Panels:
    a. Product: Lutron XP Series Switching Panels.
    b. Provide surface-mounted or flush-mounted enclosures as indicated.
    c. Switching Requirements:
        1) Utilize 20 A continuous-use rated switching modules; able to switch 20 A receptacles.
        2) Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
        3) Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
        4) Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

2.4 LED DRIVERS

A. General Requirements:
1. Operate for at least 50,000 hours at maximum case temperature and 90% non-condensing relative humidity.
2. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.
3. Provide integral recording of operating hours and maximum operating temperature to aid in troubleshooting and warranty claims.
4. Designed and tested to withstand electrostatic discharges incurred during manufacturing, installation, or field troubleshooting without impairment of performance when tested according to IEC 61000-4-2.
5. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
6. UL 8750 recognized or listed as applicable.
7. UL Type TL rated where possible to allow for easier fixture evaluation and listing of different driver series.
8. UL 1598C listed for field replacement as applicable.
9. Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
10. Class A sound rating; inaudible in a 27 dBA ambient.

11. Demonstrate no visible change in light output with a variation of plus or minus 10% change in line-voltage input.
12. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
13. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100% to 1% or 100% to 5% as applicable.
14. Meet NEMA 410 inrush requirements.
15. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
16. LED driver may be remote located up to 100 feet (30 m) from LED light engine depending on power outputs required and wire gauge utilized by installer.

B. Digital Control (when used with compatible Lutron lighting control systems):
   1. Employ power failure memory; LED driver to automatically return to the previous state/light level upon restoration of utility power.
   2. Operate from input voltage of 120 V through 277 V at 50/60Hz.
   3. Automatically go to 100% light output upon loss of control link voltage and lock out system commands until digital control link voltage is restored. Manufacturer to offer UL 924 compliance achievable through use of external Lutron Model LUT-ELI-3PSH interface upon request.
   4. Each driver responds independently per system maximum:
      a. Up to 32 occupant sensors.
      b. Up to 16 daylight sensors.
   5. Responds to digital load shed command. (Example: If light output is at 30% and a load shed command of 10% is received, the ballast automatically sets the maximum light output at 90% and lowers current light output by 3% to 27%).
   6. Digital low-voltage control wiring capable of being wired as either Class 1 or Class 2.

C. Product(s):
   1. Digital Control, Five Percent Dimming; Lutron 5-Series (LDE5-Series):
      a. Dimming Range: 100% to 5% measured output current.
      b. Typically dissipates 0.2 W standby power at 120 V and 0.3 W standby power at 277 V.
      c. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V.
      d. Constant Current Reduction (CCR) dimming method.
      e. Total Harmonic Distortion (THD): Less than 21% at full load; complies with ANSI C82.11.
      f. Constant Current Drivers:
         1) Support for downlights and pendant fixtures in select currents from 350 mA to 1.4 A to ensure a compatible driver exists.
            a) Support LED arrays up to 35 W.
            b) Models available that meet requirements for Energy Star compliance.
         2) Support for troffers, linear pendants, and linear recessed fixtures from 150 mA to 2.1 A to ensure a compatible driver exists.
            a) Support LED arrays up to 75 W.
            b) Models available to meet the Design Lights Consortium (DLC) power line quality requirements.
   2. Digital Control, 1% Dimming with Soft-On and Fade-to-Black Low End Performance; Lutron Hi-lume 1% Soft-on Fade-to-Black (LDE1-Series):
      a. Dimming Range: 100% to 1% measured output current.
      b. Features smooth fade-to-on and fade-to-black (Lutron Soft-On, Fade-to-Black) low end dimming performance for an incandescent-like dimming experience.
      c. Typically dissipates 0.2 W standby power at 120 V and 0.3 W standby power at 277 V.
      d. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V.
      e. Employs true Constant Current Reduction (CCR) dimming method from 100% to 5% light level and Pulse Width Modulation (PWM) dimming method from five percent to off.
      f. Pulse Width Modulation (PWM) frequency of 240 Hz.
      g. Total Harmonic Distortion (THD): Less than 20% at full output for drivers greater than 25 W; complies with ANSI C82.11.

h. UL Class 2 output.
i. Driver outputs to be short circuit protected, open circuit protected, and overload protected.
j. Constant Current Driver; Lutron K-Case Form Factor: Support for fixtures from 220 mA to 1.4 A over multiple operating ranges.
   1) Support LED arrays up to 40 W.
   2) Models available that meet requirements for Energy Star compliance.
k. Constant Current Driver; Lutron M-Case Form Factor: Support for fixtures from 150 mA to 2.1 A over multiple operating ranges.
   1) Support LED arrays up to 75 W.
   2) Models available to meet the Design Lights Consortium (DLC) power line quality requirements.

2.5 LIGHTING CONTROL MODULES (LUTRON ENERGY SAVER NODE)

A. Provide Lighting Control Modules as indicated or as required to control the loads as indicated.

B. General Requirements:
1. Listed to UL 508 as industrial control equipment.
2. Delivered and installed as a listed factory-assembled panel.
3. Passively cooled via free-convection, unaided by fans or other means.
4. Mounting: Surface.
5. Connection without interface to wired:
   a. Occupancy sensors.
   b. Daylight sensors.
   c. IR receivers for personal control.
6. Connects to lighting management hub via RS485.
7. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
8. Contact Closure Input:
   a. Directly accept contact closure input from a dry contact closure or sold-state output without interface to:
      1) Activate scenes.
         a) Scene activation from momentary or maintained closure.
      2) Enable or disable after hours.
         a) Automatic sweep to user-specified level after user-specified time has elapsed.
         b) System will provide occupants a visual warning prior to sweeping lights to user-specified level.
         c) Occupant can reset timeout by interacting with the lighting system.
      3) Activate or deactivate demand response (load shed).
         a) Load shed event will reduce lighting load by user-specified amount.
9. Emergency Contact Closure Input:
   a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
   b. Allow configurable zone response during emergency state.
   c. Disable control operation until emergency signal is cleared.
10. Supplies power for control link for keypads and control interfaces.
11. Distributes sensor data among multiple lighting control modules.
12. Capable of being controlled via wireless sensors and controls.

C. 0-10V Lighting Control Modules:
1. Product(s):
2. Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to single zone.
3. Single low voltage dimming module; capable of controlling following light sources:
   a. 0-10V analog voltage signal.
      1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
      2) Sink current per IEC 60929.
   b. 10V-0V analog voltage signal.
      1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.

2) Sink current per IEC 60929.

4. Switching:
   a. Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
   b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
   c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
   d. Module to integrate up to four individually controlled zones.
   e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

D. Digital Fixture Lighting Control Modules:
   1. Product(s):
      a. Lutron EcoSystem Energi Savr Node; Model QSN-1ECO-S: One EcoSystem Digital Link.
      b. Lutron EcoSystem Energi Savr Node; Model QSN-2ECO-S: Two EcoSystem Digital Links.
   2. Provides two-way feedback with digital fixtures for energy monitoring, light level status, lamp failure reporting, and ballast/driver failure reporting.
   3. Provide testing capability using manual override buttons.
   4. Each low-voltage digital communication link to support up to 64 ballasts or LED drivers capable of NFPA 70 Class 1 or Class 2 installation.

2.6 LIGHTING MANAGEMENT HUBS

A. Product: Lutron Quantum Light Management Hub.

B. Provided in a Pre-Assembled NEMA listed enclosure with terminal blocks listed for field wiring.

C. Connects to Controls and Power Panels via RS485.

D. Enables Light Management Software to control and monitor compatible dimming ballasts and ballast modules, power panels, power modules, and window treatments.
   1. Utilizes Ethernet connectivity to light management computer utilizing one of the following methods:
      a. Dedicated network.
      b. Dedicated VLAN.
      c. Shared network with Building Management System (BMS).
      d. Corporate network where managed switches are configured to allow multicasting and use of IGMP.

E. Integrates Control Station Devices, Power Panels, Shades, Preset Lighting Controls, and external inputs into a single customizable lighting control system with:
   1. Multiple Failsafe Mechanisms:
      a. Power failure detection via emergency lighting interface.
      b. Protection: Lights go to full on if ballast wires are shorted.
      c. Distributed architecture provides fault containment. Single hub failure or loss of power does not compromise lights and shades connected to other lighting management hubs.
   2. Manual overrides.
   3. Automatic control.
   4. Central computer control and monitoring.
   5. Integration with BMS via BACnet.

F. Furnished with Astronomical Time Clock.

G. Maintains a backup of the programming in a non-volatile memory capable of lasting more than 10-years without power.

H. BACnet Integration License:
   1. Provide ability to communicate by means of native BACnet IP communication (does not require interface) to lighting control system from a user-supplied 10BASE-T or 100BASE-T Ethernet network.
   2. Requires only one network connection per system.

3. Lighting control system to be BACnet Test Laboratory (BTL) listed.
4. Basic BACnet integration license:
    a. The BACnet integrator can command:
        1) Area light output.
        2) Area enable or disable after hours mode.
        3) Area load shed level.
        4) Area load shed enable/disable.
        5) Enable/Disable:
            a) Area occupancy sensors.
            b) Area daylighting.
        6) Daylighting level.
        7) Area occupied and unoccupied level
        8) Occupancy sensor timeouts.
    b. The BACnet integrator can monitor:
        1) Area on/off status.
        2) Area occupancy status.
        3) Area fault.
            a) Lamp failures.
            b) Control devices not responding.
        4) Area load shed status.
        5) Area instantaneous energy usage and maximum potential power usage.
        6) Energy savings broken out by strategy (occupancy, timeclock, daylighting, personal control, tuning, load shed) down to the individual area.
        7) Enable/Disable:
            a) Area occupancy sensors.
            b) Daylighting.
            c) Timeclocks.
        8) Daylighting level.
        9) Light levels from photo sensors or Radio Window sensors.
        10) Area occupied and unoccupied level.
        11) Occupancy sensor timeouts.
5. Integration with other devices over Ethernet via Telnet using the Lutron Integration Protocol.
6. Control other devices over Ethernet via TCP or Telnet by sending device specific strings.

2.7 LIGHTING MANAGEMENT SYSTEM COMPUTERS

A. Computers:
    1. Product: Lutron Q-Manager.
    2. System PC (Desktop/Laptop):
        a. Suitable for occasional programming, monitoring, and control of digital network lighting controls.
        b. Unless otherwise indicated, computer(s) to be provided by others, meeting Lighting Control System Manufacturer's minimum requirements.
        c. Minimum Hardware Requirements:
            1) Processor: Single Intel® Core® i3 processor with minimum speed of 2.4 GHz.
            2) 4 GB RAM.
            3) 250 GB hard drive (40 GB for application).
            4) One 10/100/1000 Ethernet network interface for communication with lighting management hubs.
            5) Monitor with 1280 x 1024 resolution.
            6) 4 USB 2.0 ports.
            7) Dedicated Graphics Card with 256 MB of memory.
        d. Minimum Software Requirements:
            1) Licensed installation of US English 64-bit Microsoft® Windows® 7 Professional with Service Pack 1, US English 64-bit Microsoft® Windows® 8 Professional, or US English 64-bit Microsoft® Windows® 8.1 Professional.
            2) Microsoft® Internet Information Services (IIS) 7 or later.
            3) Microsoft® Internet Explorer 9 or later.
            4) Microsoft®.NET Framework 3.5.

5) Microsoft®.NET Framework 4.5.

3. Server:
   a. Suitable for 24 hour per day, 7 day per week programming, monitoring, control, and data logging of digital-network lighting controls.
   b. Suitable to handle client machine request in multi-computer systems.
   c. Unless otherwise indicated, computer to be provided by others, meeting Lighting Control System Manufacturer's minimum requirements.
   d. Minimum Hardware Requirements:
      1) Processor: Quad Core Intel® Xeon® processor.
      2) 8 GB Ram.
      3) 250 GB hard drive (40 GB for application and database).
      4) Two 10/100/1000 Ethernet network interfaces - one for communication with lighting management hubs and one for communication with corporate intranet to allow access from system PCs and/or energy saving display terminals. Only one Ethernet Network Interface is required if all lighting management hubs and client PCs are on the same network.
      5) Monitor with 1280 x 1024 resolution.
      6) 4 USB 2.0 ports.
      7) Dedicated Graphics Card with 256 MB of memory (only required if running client software from the server).
   e. Minimum Software Requirements:
      1) Licensed installation of US English 64-bit Microsoft® Windows® Server 2008 R2, Windows Server 2012 R1, or Windows Server 2012 R2.
      2) Microsoft® Internet Information Services (IIS) 7 or later.
      3) Microsoft® Internet Explorer 9 or later.
      4) Microsoft®.NET Framework 3.5.
      5) Microsoft®.NET Framework 4.5.

2.8 LIGHTING MANAGEMENT SYSTEM SOFTWARE

A. Provide System Software License and Hardware that is designed, tested, manufactured, and warranted by a single Manufacturer.

B. Configuration Setup Software:
   1. Product: Lutron Q-Design.
   2. Suitable to make system programming and configuration changes using a Graphical Floor Plan view or a generic system layout.
   3. Windows-based, capable of running on either central server or a remote client over TCP/IP connection.
   4. Publish Graphical Floor Plan: Allows the user to publish new Graphical Floor Plan files, allowing users to monitor the status of lights, occupancy of areas, and daylighting status.
   5. Back-Up Project Database: Allows the user to back up the Project database that holds all the configuration information for the system, including keypad programming, area scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.
   6. Publish Project Database: Allows the user to send a new Project database to the server and download the new configuration to the system. The Project database holds all the configuration information for the system, including keypad programming, area scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.
   7. Allows Manufacturer (either remotely or with on-site service call) or end-user (with training) to:
      a. Capture system design:
         1) Geographical layout.
         2) Load schedule zoning.
         3) Equipment schedule.
         4) Equipment assignment to lighting management hubs.
         5) Daylighting design.
      b. Define the configuration for the following in each area:
         1) Lighting scenes.
         2) Control station devices.
         3) Interface and integration equipment.

4) Occupancy/after hours.
5) Partitioning.
6) Daylighting.
7) Emergency lighting.
8) Night lights.

c. Startup:
1) Addressing.
2) Daylighting.
3) Provide customized conditional programming.

C. Control and Monitor Software:

1. Product: Lutron Quantum Vue.
2. General Requirements:
a. Web-based; runs on most HTML5 compatible browsers (including Internet Explorer, Chrome, and Safari).
b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone; optimized for displays of 1024 by 768 pixels or higher.
c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
e. All functionality listed below must be available via a single application.
3. System Navigation and Status Reporting:
a. Performed using Graphical Floor Plan view or a generic system layout.
b. Graphical Floor Plan View: Utilizes customized CAD Based Drawing of the building. Pan and zoom feature allows for easy navigation; dynamically adjusts the details presented based on zoom level.
c. Area, scene, and zone names can be changed in real time.
d. Adjustments can be made based on area type.
4. Control of Lights:
a. Control and monitor individual lights from a Graphical Floor Plan (with Lutron EcoSystem digital ballasts/drivers).
1) Individual lights can be monitored for on/off status.
2) Individual lights can be turned on/off or sent to a specific level.
3) High end of individual lights can be tuned/trimmed.
b. Control and monitor zone/area lights.
1) Area lights can be monitored for on/off status.
2) All lights in an area can be turned on/off or sent to a specific level.
3) For areas that have been zoned, these areas may be sent to a predefined lighting scene, and individual zones may be controlled.
4) Area lighting scenes can be renamed and modified in real-time, changing the levels that zones go to when a scene is activated.
5) High and low end of area lighting can be tuned/trimmed.
c. Control and monitor area partition status from a Graphical Floor Plan.
5. Occupancy:
a. Area occupancy can be monitored.
b. Area occupancy can be disabled to override occupancy control or in case of occupancy sensor problems.
c. Area occupancy settings including level that lights turn on to when area is occupied, and level that lights turn off to when area is unoccupied can be changed in real-time.
d. Monitor energy savings due to occupancy down to an individual area.
6. Daylighting:
a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
b. Daylight calibration can be adjusted for each daylit area.
c. Daylight status can be monitored.
d. Monitor energy savings due to daylight harvesting down to an individual area.
7. Load Shedding; Lutron IntelliDemand: Allows the Building Manager to monitor whole building lighting power usage and apply a customized load shed reduction to selected areas, thereby

reducing a building's power usage; load shedding triggered via Quantum Vue software or BACnet.

8. Scheduling: Schedule time of day and astronomic time clock events to automate functions.
   a. Adjust or disable a single occurrence of a repeating scheduled event.
   b. Easily monitor and adjust scheduled events using a weekly calendar view.
9. Reporting: Provide reporting capability that allows the Building Manager to gather real-time and historical information about the system as follows:
   a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas.
   b. Power Reports: Show power usage trend over a period of time for one or more areas.
   c. Energy Density Report: Show energy usage in W/sq ft.
   d. Energy Savings by Strategy Report: Show energy savings for any area broken down by strategy (tuning, occupancy, daylighting, scheduled events, personal control, and load shedding).
   e. Space Utilization/Occupancy Reports: Show historical occupancy over a period of time for one or more areas using a graphical floor plan, generic system layout, and/or graphs and charts.
   f. Activity Report: Show what activity has taken place over a period of time for one or more areas. Activity includes occupant activities (e.g. wall controls being pressed), building manager operation (e.g. controlling/changing areas using the control and monitor tool), and device failures (e.g. keypads or ballasts that are not responding).
   g. Lamp Failure Report: Shows which areas are currently reporting lamp failures.
   h. Sensor Level Report: Shows the light level in footcandles of any photo sensor in the system.
   i. Alert Activity Report: Capable of generating historical reports of all alert activity within the system.
10. Diagnostics: Allows the Building Manager to check on the status of all equipment in the lighting control system. Devices to be listed with a reporting status of OK, missing, or unknown.
11. Alerts and Alarms: Monitors the system for designated events/triggers and automatically generates alerts according to configured response criteria.
    a. Capable of monitoring for the following events/triggers:
       1) A failed piece of equipment (e.g. ballast, control, sensor, etc.); alert cleared when equipment is replaced.
       2) A lamp outage (for compatible EcoSystem digital electronic dimming ballasts only); alert cleared when lamp is replaced.
       3) Low battery conditions in battery-operated sensors and controls; alert cleared when battery is replaced.
       4) Luminaires with lamp operating hours in excess of designated time.
       5) A load shed event; alert generated for beginning and end of trigger.
       6) Energy usage higher than designated threshold target.
       7) Potential light level condition discrepancies (daylight sensors not agreeing with expected lighting status).
       8) Potential sensor failures (Radio Window sensors that have not seen a change in light level).
    b. View alerts on a customized Graphical Floor Plan.
    c. Capable of generating alerts through visible changes in software or through email messages.
    d. Capable of customizing the frequency of alerts and providing notifications immediately or through daily, weekly, or monthly summaries.
    e. Capable of sending different alerts to different system users.
    f. Capable of generating historical reports of all alert activity within the system.
12. Administration:
    a. Users: Allows new user accounts to be created and existing user accounts to be edited.
       1) Supports Active Directory (LDAP) tying user accounts to network accounts.
    b. Area and feature access can be restricted based on login credentials with assigned levels of access rights (Monitor, Control Only, Control and Edit, Admin) and customized access levels available.
13. Quick Controls: Create shortcuts to activate customized system-wide actions, such as updating lighting and/or shade levels.

14. Provides control/monitoring of partition status to automatically reconfigure how the space operates based on the partition's open/closed status.
15. Variables: Used for custom program of a system and/or to signal a third party system. Any change may cause a change in the behavior of the system.
    a. View the current state of system variables across subsystems.
    b. Update the current variable state across all subsystems.
16. Device Lock/Unlock: Allows the building manager to lock control station devices to prevent building occupants from activating their programming (button presses), until they are unlocked.
    a. Keypads can be locked to help ensure occupants cannot change light and shade levels in a public space during specific events or business hours.
    b. Keypads can be unlocked after events/during afterhours to allow maintenance, cleaning, security, and others to perform their tasks without needing to contact a Building Manager.

D. Contractor shall provide factory commissioning to support prefunctional and functional testing with CxA witnessing. See General Commissioning Requirements Section 019113.

2.9 CONTROL STATIONS

A. Provide Control Stations with configuration as indicated or as required to control the loads as indicated.

B. Wired Control Stations:
1. General Requirements:
    a. Power: Class 2 (low voltage).
    b. UL listed.
    c. Provide faceplates with concealed mounting hardware.
    d. Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
    e. Finish: As specified for wall controls in "Device Finishes" under DIGITAL NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS article above.
2. Multi-Scene Wired Control:
    a. General Requirements:
        1) Allows control of any devices part of the lighting control system.
        2) Allows for easy reprogramming without replacing unit.
        3) Replacement of units does not require reprogramming.
        4) Communications: Utilize RS485 wiring for low-voltage communications link.
        5) Engrave keypads with button, zone, and scene descriptions as indicated on the Drawings.
        6) Software Configuration:
            a) Customizable control station device button functionality:
                - Buttons can be programmed to perform single defined action.
                - Buttons can be programmed to perform defined action on press and defined action on release.
                - Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.
                - Buttons can be programmed to perform automatic sequence of defined actions.
                - Capable of deactivating select keypads to prevent accidental changes to light levels.
                - Buttons can be programmed for raise/lower of defined loads.
                - Buttons can be programmed to toggle defined set of loads on/off.
        7) Status LEDs:
            a) Upon button press, LEDs to immediately illuminate.
            b) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.
            c) Support logic that defines when LED is illuminated:
                - Scene logic (logic is true when all zones are at defined levels).

- Room logic (logic is true when at least one zone is on).
- Pathway logic (logic is true when at least one zone is on).
- Last scene (logic is true when spaces are in defined scenes).

b. Wired Keypads; Lutron see Touch QS Wallstations:
   1) Style: Architectural Non-Insert Style.
   2) Mounting: Wallbox or low-voltage mounting bracket; provide wall plates with concealed mounting hardware.
   3) Button/Engraving Backlighting:
      a) Utilize backlighting for buttons and associated engraving to provide readability under all light conditions.
      b) Backlight intensity adjustable via programming software.
   4) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
   5) Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.
   6) Terminal block inputs to be over-voltage and miswire-protected against reversals and shorts.

c. Wired Keypads; Lutron QS Wired Palladiom Wallstations:
   1) Style: Architectural Style.
   2) Mounting: Wallbox; provide wall plates with concealed mounting hardware.
   3) Buttons and Faceplate:
      a) Buttons to be greater than 0.65 inch (16.5 mm) in height to provide large target area for ease of use and actuation.
      b) Front of buttons to be flush with faceplate.
      c) Buttons and faceplate to be of the same material and finish (e.g. plastic/plastic, glass/glass, metal/metal).
      d) Buttons to depress and provide tactile feedback of a successful button push. Controls utilizing capacitive or resistive touch technology are not acceptable.
      e) Gaps to be less than 0.007 inch (0.18 mm) between buttons and less than 0.15 inch (3.8 mm) between buttons and faceplate.
   4) Button/Engraving Backlighting:
      a) Backlighting to be visible through engraved text to provide clear readability in a variety of lighting conditions.
      b) Indicate active scene through the intensity of the backlighting (brighter backlit text indicates the active state).
      c) Backlight intensity adjustable via programming software; capable of dynamic adjustment during usage based on conditional logic (time of day, button press, etc.).
      d) Backlight intensity automatically adjusts based on room ambient light level.
   5) Keypads to allow field-customization of button color and engraving using field-changeable replacement kits.
   6) Terminal block inputs to be over-voltage and miswire-protected against reversals and shorts.

C. Wireless (Radio Frequency) Controls:
   1. Product(s):
      a. Type _____ - 4-Button; Lutron Pico Wireless Control Model PJ2-4B.
         1) Button Marking: Scene keypads (light).
   2. Quantity: As indicated on the Drawings.
   3. Communicates via radio frequency to compatible dimmers, switches, and plug-in modules.
   4. Does not require external power packs, power or communication wiring.
   5. Allows for easy reprogramming without replacing unit.
   6. Button Programming:
      a. Single action.
      b. Toggle action.
      c. Defined action on press and defined action on release.
   7. Includes LED to indicate button press or programming mode status.

8. Mounting:
    a. Capable of being mounted with a table stand or directly to a wall under a faceplate.
    b. Faceplates: Provide concealed mounting hardware.
9. Power: Battery-operated with minimum 10-year battery life.
10. Finish: As specified for wall controls in "Device Finishes" under DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS article above.

2.10 LOW-VOLTAGE CONTROL INTERFACES

A. Provide Low-Voltage Control Interfaces as indicated or as required to control the loads as indicated.

B. UL listed.

C. Sensor Modules:
1. Products:
    a. Sensor module with both wired and wireless inputs; Lutron Model QSM2-4W-C.
2. Wired Modules:
    a. Provide wired inputs for:
        1) Occupancy sensors.
        2) Daylight sensors.
        3) IR receivers for personal control.
        4) Digital ballast wall stations.
3. Wireless Modules:
    a. Provide wireless communication inputs for:
        1) Occupancy sensors.
        2) Daylight sensors.
        3) Wireless controller.
    b. RF Range: 30 feet (9 m) between sensor and compatible RF receiving devices.
    c. RF Frequency: 434 MHz; operates in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
4. Communicate sensor information to wired low-voltage digital link for use by compatible devices.

2.11 WIRED SENSORS

A. Wired Occupancy Sensors:
1. General Requirements:
    a. Connects directly to compatible ballasts and modules without the need of a power pack or other interface.
    b. Turns off or reduces lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.
    c. Accommodates all conditions of space utilization and all irregular work hours and habits.
    d. Comply with UL 94.
    e. Self-Adaptive Sensors: Continually adjusts sensitivity and timing to ensure optimal lighting control for any use of the space; furnished with field-adjustable controls for time delay and sensitivity to override any adaptive features.
    f. Provide capability to:
        1) Add additional timeout system-wide without need to make local adjustment on sensor.
        2) Group multiple sensors.
    g. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.
    h. Furnished with all necessary mounting hardware and instructions.
    i. Class 2 devices.
    j. Color: White.
2. Wired Dual Technology Sensors:
    a. Passive Infrared: Utilize multiple segmented lenses, with internal grooves to eliminate dust and residue build-up.
    b. Ultrasonic: Utilize an operating frequency of 32 kHz or 40 kHz, crystal-controlled to operate within plus/minus 0.005% tolerance.

2.12 WIRELESS SENSORS

A. General Requirements:
   1. Operational life of 10 years without the need to replace batteries when installed per Manufacturer's instructions.
   2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
   3. Does not require external power packs, power wiring, or communication wiring.
   4. Capable of being placed in test mode to verify correct operation from the face of the unit.
   5. RF Range: 30 feet (9 m) between sensor and compatible RF receiving device(s).
   6. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 15, for Class B application.

B. Wireless Occupancy/Vacancy Sensors:
   1. General Requirements:
      a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
      b. Utilize multiple segmented lenses, with internal grooves to eliminate dust and residue build-up.
      c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
      d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/ manual-on, and sensitivity.
      e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
      f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1% to 100%.
      g. Color: White.
      h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
      i. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
      j. Sensor lens to illuminate during test mode when motion is detected to allow installer to verify coverage prior to permanent mounting.
      k. Ceiling-Mounted Sensors:
         1) Provide customizable mask to block off unwanted viewing areas.
   2. Wireless Combination Occupancy/Vacancy Sensors:
      a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).

C. Wireless Daylight Sensors:
   1. Product: Lutron Model LFR2-DCRB.
   2. Open-loop basis for daylight sensor control scheme.
   3. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
   4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
   5. Provide linear response from 0 to 10,000 footcandles.
   6. Color: White.
   7. Mounting:
      a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
      b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.

c. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.

8. Meets California Title 24 requirements.

2.13 ACCESSORIES

A. Emergency Lighting Interface:

1. Product: Lutron Model LUT-ELI.
2. Provides total system listing to UL 924 when used with lighting control system.
3. Senses all three phases of building power.
4. Provides an output to power panels or digital ballast interfaces if power on any phase fails and sends all lights controlled by these devices to an emergency light level setting. Lights to return to their previous intensities when normal power is restored.
5. Accepts a contact closure input from a fire alarm control panel.

B. Provide Power Supplies as indicated or as required to power system devices and accessories.

2.14 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory Testing; Lutron Standard Factory Testing:

1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
2. Perform full-function factory testing on 100% of all ballasts and LED drivers.
3. Perform factory audit burn-in of all dimming assemblies and panels at 104 degrees F (40 degrees C) at full load for 2-hours.

PART 3 EXECUTION

3.1 INSTALLATION

A. Perform Work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, except for mounting heights specified in those Standards.

B. Install Products in accordance with Manufacturer's instructions.

C. Provide Dedicated Network between lighting management system computer and lighting management hubs.

D. Define Each Dimmer/Relay Load Type, assign each load to a zone, and set control functions.

E. Sensor Locations:

1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.

F. Ensure that Daylight Sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

G. Lamp Burn-In: Operate lamps at full output for prescribed period per Manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

H. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

I. System and Network Integration Consultation; Lutron LSC-INT-VISIT: Include as part of the base bid additional costs for Lighting Control Manufacturer to conduct meeting with Facility Representative and other related Equipment Manufacturers to discuss equipment and integration procedures.
   1. Coordinate scheduling of visit with Lighting Control Manufacturer. Manufacturer recommends that this visit be scheduled early in construction phase, after system purchase but prior to system installation.

J. Identify System Components in accordance with Section 260553.

3.2 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Manufacturer's Startup Services; Lutron Standard Startup Services:
   1. Manufacturer's Authorized Service Representative to conduct minimum of two site visits to ensure proper system installation and operation.
   2. Conduct Pre-Installation visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".
   3. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:
      a. Verify connection of power wiring and load circuits.
      b. Verify connection and location of controls.
      c. Energize lighting management hubs and download system data program.
      d. Address devices.
      e. Verify proper connection of panel links (low voltage/data) and address panel.
      f. Download system panel data to dimming/switching panels.
      g. Verify system operation control by control.
      h. Verify proper operation of Manufacturer's interfacing equipment.
      i. Verify proper operation of Manufacturer's supplied PC and installed programs.
      j. Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.
      k. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS".
      l. Train Owner's Representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".
      m. Obtain sign-off on system functions.
   4. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.3 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for Commissioning Requirements.

B. Title 24 Acceptance Testing Service; Lutron LSC-SPV-DOC-T24: Include as part of the base bid additional costs for Lighting Control Manufacturer to perform lighting control acceptance testing in accordance with CAL TITLE 24 P6. Submit required documentation.

3.4 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for Closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration:

1. On-Site Performance-Verification Walkthrough; Lutron LSC-WALK: Include as part of the base bid additional costs for Lighting Control Manufacturer to provide on-site demonstration of system functionality to Commissioning Agent.

D. Training:

1. Include services of Manufacturer's Authorized Service Representative to perform on-site training of Owner's Personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.
   a. Include training on software to be provided:
      1) Configuration software used to make system programming and configuration changes.
      2) Control and monitor.

3.5 MAINTENANCE

~~A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.~~ ***ADD 3***

A~~B~~. Software Maintenance Agreement; Lutron LSC-SMA: Include as part of the base bid additional costs for Manufacturer to provide quarterly compatibility testing results for PC-based lighting control software and new patches issued for Microsoft Operating System, Database, and Browser tools. ***ADD 3***

1. If new Microsoft patches create a software conflict, Manufacturer to provide lighting control software patches to ensure continued operation.

B~~C~~. System Optimization Visit; Lutron LSC-SYSOPT: Include as part of the base bid additional costs for Lighting Control System Manufacturer to visit site 6-months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility. ***ADD 3***

END OF SECTION 260943

091517/1010006

SECTION 263353
UNINTERRUPTIBLE POWER SUPPLY - UPS

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 WORK INCLUDED:

All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for an incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

A. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.

B. General Provisions and Requirements for Electrical Work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Detailed Shop Drawings including Dimensioned Plans, elevations, details, schematic and point-to-point wiring diagrams and descriptive literature.

B. Submit Transformer Test Reports.

C. System Configuration with Single Line Diagrams, show both internal and external wiring connections on Single Line Diagrams.

D. All Circuit Breakers and Fuses shall be identified by location, frame size, trip rating and Manufacturer with type number, terminal locations and interconnect wiring diagrams. Submit engineered settings for all UPS adjustments, protection devices, time-outs, alarm pickup-dropout, software controls etc.

E. Size and Weight of Individual Shipping Units, weight dimensions and heat dissipation of each unit.

F. Detailed Descriptions of Equipment to be furnished, including all deviations from the Contract Document requirements.

G. Detailed Layouts of all metering, alarm and mimic panels. Monitoring and metering sensing points shall be shown on the single line diagram.

H. Short Circuit, Coordination and Arc-Flash (Additional Requirements)
   1. Perform and submit engineered settings for each equipment location, fuse and adjustable circuit breaker device, showing the correct time and current settings to provide the coordination within the limits of the specified equipment, per the latest applicable standards of IEEE and ANSI. Provide electrical system short circuit fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash calculations as part of the Coordination Analysis recommendations.
   2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
   3. The goal is to minimize an unexpected but necessary electrical system outage and personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract Equipment. Shall comply with, but not limited to:
      a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
      b. IEEE-399, Recommended Practice for Industrial and Commercial Power System Analysis.
      c. IEEE-1584, Guide to Performing Arc-Flash Hazard Study.
      d. CEC

I. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements).
   1. The complete Uninterruptable Power System assembly; including circuit protection devices, inverters, batteries, housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested.
      a. Wind loading all outdoor equipment locations.
      b. Earthquake Seismic requirements of CBC Seismic withstand all indoor and all outdoor equipment locations.
   2. Shall withstand, survive and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
   3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance Test Seismic Qualification of proposed UPS equipment shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) Seismic event motion, Certified and Approved by the AHJ.
   4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:
      a. 100MPH-West Coast States USA, California, and Hawaii.
   5. Seismic test shall be performed by a third party independent Test Laboratory. Wind Analysis and Seismic Testing and Reports shall be Certified, Signed and "Stamped" by PE Professional Engineer Licensed and in good standing in the State, Civil Engineer or Structural Engineer.

1.3 GENERAL

A. Description
   1. Each Uninterruptible Power Supply (UPS) system shall provide online double conversion, continuous operation, solid state static, uninterruptible electric power supply and distribution. The UPS shall function as an active electrical power source, electrical power conditioning and active control system in conjunction with the following:
      a. The facility normal (utility) incoming services electrical supply source or sources.
      b. The Direct Current (DC) bus UPS input source.
      c. The facility electrical loads connected to the UPS output
   2. The UPS shall automatically provide continuity of electric power within specified tolerances to the UPS output loads, without interruption, including during failure or deterioration of the normal input power supply. Continuity of electric power to the load shall be maintained for an emergency time period with the UPS supplied by battery power up to the specified time and during restoration of the normal utility/ generator power supply.
   3. The UPS shall provide 100% continuous conditioned; uninterrupted electric power of the specified limited duration for any combination of linear and nonlinear UPS output loads shown connected to the UPS.
   4. Each UPS shall consist of a converter; DC input bus/charger and battery system; solid state inverters; maintenance bypass transfer circuit; controls and monitoring systems; synchronizing systems; circuit protective devices; operating software, and equipment enclosures.
   5. UPS Sold State Electronic Components
      a. Digital-Signal-Processing using Pulse-Width-Modulation (PWM) of all UPS control and monitoring functions. Converter and inverter modules shall use Insulated-Gate Bipolar Transistors (IGBT).
   6. UPS shall be suitable and recommended by the Manufacturer for operation on normal utility electrical input power and/or standby engine generator supplied input electrical power.
   7. The UPS shall protect and correct the electrical supply to loads connected to the UPS resulting from electrical power failures, power sags, over voltages and power surges, frequency variations, brownouts, bidirectional electrical noise, bidirectional high voltage spikes/lightning, bidirectional switching transients, bidirectional harmonic distortion.
   8. UPS internal power supplies for UPS controls and fans shall be redundant "hot-swappable" without affecting or disrupting UPS output loads if one power supply fails or is removed for maintenance. Provide power supply failure alarm.

9. UPS equipment shall all be the product of the same Manufacturer.
    a. UPS units, limited to the following pursuant to direction from Owner. As manufactured by Eaton; or APC/Schneider Electric.

B. Standards and Codes
1. The UPS shall be certified to conform, to be designed and to be manufactured to comply with the following Standards and Codes:
    a. Underwriters Laboratory – UL 1778
    b. Canadian Standards Association – CSA 22.2
    c. International Electrotechnical Committee – IEC Semiconductor Converter Standards
    d. International Organization for Standardization – ISO 9001
    e. California Electrical Code – CEC
    f. Federal Communications Commission – FCC Part 15 Subpart-J, Class-A for conducted and radiated noise
    g. Institute of Electrical and Electronic Engineers – IEEE 587, Category A and B.
    h. National Electrical Manufacturers Associates – NEMA PE-1
    i. American National Standards Institute – ANSI 62.41
    j. EIA/TIA – 568B
    k. Local applicable Standards and Building Codes

PART 2 PRODUCTS

2.1 DESCRIPTION AND OPERATION

A. UPS System Operation
1. The UPS shall operate continuously at described capacity and performances as a continuous on-line automatic system in the following modes to supply rated voltage and kVA output to the UPS connected loads.
2. Modular configuration, providing incremental UPS electrical load and battery capacity expansion of the initial UPS capacity installation.

B. Normal Mode
1. The UPS inverters continuously supplies output to the loads connected to the UPS. Convert the UPS normal input voltage to regulated DC voltage for input to the inverter and simultaneously supply regulated DC as a float charge to the UPS D.C. bus storage batteries.
2. If the DC bus/battery system is disconnected from the UPS for reasons of overload, failure or maintenance of the DC bus/battery system, the UPS shall continue to function and meet all of the specified performance characteristics, for the connected output loads, except the normal input source power outage back-up time capacity for the DC bus/batteries.

C. Emergency Mode
a. Upon failure of the normal input power to the UPS, the inverter shall derive its input from the DC bus UPS battery system and provide continuous uninterruptible power to the loads connected to the UPS output. The transition from UPS normal input power to UPS DC bus battery system shall be accomplished without any switching or coupling and without any interrupting of power to the loads connected to the output of the UPS as a result of either a failure or restoration of the normal input source power to UPS.

D. Recharge Mode
1. Upon restoration of stable nominal normal input power to the UPS, the converter shall automatically reactivate and provide regulated DC voltage for input to the inverter and simultaneously supply regulated DC recharging of the DC bus UPS storage batteries. The recharge process shall occur automatically and without any interruption of the full load output to the loads connected to the UPS.
2. Trickle charge maintain battery recharge with a trickle charge and float charge to full 100% battery capacity. Provide equalizing voltage charge to batteries controlled by the UPS control system.

E. Maintenance – Bypass Mode

1. "Make before break internal bypass switch to provide bypass of normal input power around the UPS to the UPS output loads. The maintenance bypass shall provide electric isolation of the UPS from the UPS normal source input power, the D.C. input bus; inverters/chargers; static switch; and the UPS output loads, without any interruption (make before break) of power to the UPS output loads.
2. The maintenance bypass system shall connect the UPS output loads to:
   a. The same UPS normal input power source as the UPS
3. The maintenance bypass system shall automatically insure the bypass input source and load output are synchronized prior to permitting bypass mode operation.
4. The bypass system shall provide for a procedure to electrically and physically isolate the bypass system from the input sources, load output and UPS/inverters – chargers – batteries when the UPS is supplying the output load.
   The isolation shall allow, without any interruption to the output load, inspecting, testing, repair, removal/reinstallation of the maintenance bypass system components, without any possibility of contact with the energized UPS/inverters – charger – batteries and output loads.
5. The UPS/inverters – charger – battery systems shall be electrically isolated and physically separated from the UPS maintenance bypass systems; the input sources; the load output, when the UPS is in the bypass modes. The isolation, without any interruption to the output load, shall allow inspecting, testing, repair, removal/reinstallation of the bypassed components of the UPS without any possibility of contact with the energized UPS maintenance bypass system components and output loads.

2.2 DEFINITIONS

A. Uninterruptible Power System (UPS) - All components within the UPS module cabinet(s), separate battery cabinet(s), load output and bypass modules which function as a system to provide continuous, conditioned AC power to a load.

B. UPS Module Cabinet - Metal enclosure(s) which contain the rectifier/charger, the inverter, the maintenance bypass switches, the external operator controls, and the internal control system required to provide specified AC power to a load.

C. Battery Cabinet - Metal enclosure(s) which contain maintenance free sealed batteries sufficient to maintain UPS output according with the specifications and a battery disconnect circuit breaker.

D. UPS Module - The rectifier/charger and inverter units which, under the supervision of the internal control system and external operator controls, provide specified AC power to a load.

E. Rectifier/Charger - The UPS component which contains the equipment and controls necessary to convert input AC power to the regulated bus power required for battery charging and for supplying power to the inverter.

F. Inverter - The UPS component that contains the equipment and controls necessary to convert DC bus power from the rectifier/charger or the battery to AC power required by the UPS connected output load.

G. Internal Control System - The signal processing circuits which regulate the power conversion processes, detect fault conditions, and control the sequence of operation of the UPS. This term may be shortened to "control system".

H. Operator Controls - The controls, which are used by the operator to monitor and operate the UPS.

I. Maintenance Bypass – the automatic operation device that connects the UPS output load to the UPS input source when the UPS Module and Bypass cannot supply continuous power.

J. Automatic Bypass Static Transfer Switch - The device, which connects the UPS output load to the static bypass line when the UPS Module cannot supply continuous power.

K. Maintenance Bypass Line - The line, which connects electricity directly from the input power to the UPS connected output load during maintenance or whenever the UPS is not operational.

L. Input Power Source - Power provided by the normal utility power source or auxiliary emergency standby engine generator source, which is connected to the input of the UPS.

2.3 ELECTRICAL PERFORMANCE CHARACTERISTICS

A. General
   1. Grounding:
      a. The UPS output load neutral shall be electrically isolated from the UPS input source neutral, when the UPS is operating in the normal mode.
      b. The UPS shall be provided with equipment ground terminal bus and neutral terminal bus on each incoming source line side and load output side.
      c. Provide for bonding the UPS load output system neutral bus and ground bus to the incoming source line side neutral bus and ground bus when the UPS is in the Bypass Modes.
   2. The UPS shall comply with US Government Agency FCC – Class A RFI requirements for all operating modes.
   3. Input voltages, output voltages, kVA/kW output load rating and phase configurations as shown on the Drawings and specified herein.
   4. UPS - Electrical voltage capacities
      a. UPS normal input source lineside voltage 208/120-volt - 3 phase, 4 wire, 60Hz AC grounded.
      b. UPS Maintenance-Bypass input source line side voltage, 208/120 volt - phase, 4 wire, 60Hz AC grounded.
      c. UPS output load voltage 208/120 volt - 3 phase, 4 wire, 60Hz AC grounded.
      d. Refer to Drawings for additional information.
   5. UPS - Electrical load capacities
      a. UPS initial output full load capacity as indicated on Drawings.
      b. UPS modular full load output future expansion capacity up to additional 150-percent.
   6. UPS - Electrical load operating DC bus battery capacity continuous time duration at full rated output load not less than 30-minutes.

B. UPS Normal Mode Input (Line Side Source) AC Sinewave, for Constant Rated Output
   1. Voltage range tolerance without any DC bus battery discharge or transfer to Bypass Modes: ± 15%
   2. 60HZ AC frequency range tolerance without any DC bus battery discharge or transfer to Bypass Modes: ± 5%
   3. Reflected input power factor shall never exceed 1.0 (unity) when operating in the Normal Mode or Recharge Mode
      a. At 100% load — 0.92 lagging, minimum
      b. At 50% load — 0.85 lagging, minimum
      c. When operating in the Bypass Modes the reflected power factor shall track UPS load power factor.
   4. Maximum reflected Total Harmonic Distortion (THD) including UPS load contributions
      a. At 100% load — 7%
      b. At 50% load — 10%
      c. When operating in the Bypass Modes the reflected THD shall track the UPS load THD.
   5. Total UPS Efficiency when operating in any mode, including input/output isolation transformer losses:
      a. At 100% load — Greater than 92%
      b. At 50% load — Greater than 89%
      c. UPS efficiency shall be the measured output KW divided by the measured input kW; with a connected load power factor of 0.8 lagging and the DC bus batteries fully charged operating on-trickle float charge.
   6. Maximum magnetizing in rush current:
      a. 1.0Hz maximum or less duration – six times normal fullload input current
   7. Input Source Load Limits
      a. The UPS shall limit the total normal source input load of the UPS to a value not to exceed 130% of the UPS continuous output kVA full load rating.

b. The input source load limit value shall include the UPS DC battery recharging loads, DC battery trickle charging loads, UPS full steady state rated output loads and the UPS internal operating losses.

C. UPS Output (Load Side) AC Sinewave

The UPS shall comply with the load output electrical characteristics described below, when the UPS is operating in the Normal Mode, Emergency Mode or Recharge Mode. The UPS load output electrical characteristics shall track the UPS input source lineside when the UPS is operating in the Bypass Modes.

1. Dynamic voltage regulations, from 0kVA to full load rating, phase-to-phase or phase-to-neutral.
   a. Balanced loads ± 0.5%
   b. Unbalanced loads ± 2%
2. Maximum voltage transient response
   a. 20% output load step ± 3%
   b. 50% output load step ± 4%
   c. 100% output load step ± 5%
   d. Loss or return of AC input voltage ± 1%
3. Voltage transient recovery time of rated voltage to within 1%, less than 1.0Hz.
4. Voltage Total Harmonic Distortion (THD) not including connected load harmonic distortion contribution.
   a. 100% linear load 2%
   b. 100% non-linear load 5%
5. Overload capacity while maintaining voltage regulation within ± 2% and while maintaining input source load limits.
   a. 125% of full load output for 600 seconds.
   b. 150% for 30 seconds.
   c. 200% for 20 seconds.
   d. 1000% for up to 1-Hz.
6. Manual voltage adjustment: ± 5%
7. Frequency stability for all specified load conditions, DC bus voltage conditions and temperature conditions
   a. Free running for all load conditions, DC bus voltage conditions and temperature conditions: 60Hz ± 0.1% in a 24 hour period; ±1% in a 6 month period
   b. Maximum slew rate 0.1HZ per second
8. Maximum Phase to Phase frequency Displacement (Imbalance)
   a. Balanced loads 120 degrees ± 1 degree
   b. 100% unbalanced loads 120 degrees ± 3 degrees
9. Connected load power factor 20% lagging to 130% leading for nominal UPS output/input operation.
10. Output synchronization:
    a. The UPS output shall stay synchronized with the automatic bypass input source, if no automatic bypass system is present then maintain synchronization with the manual bypass input source line frequency, provided the static bypass input source line remains within the nominal frequency. Where a bypass is not required to be provided with the UPS, the UPS shall stay synchronized with normal input source.
    b. If the input source line frequency goes outside described limits, the inverter shall break synchronization with the input source line and run on the UPS internal reference frequency. When the input source line frequency returns, within described limits, the inverter output shall automatically re-synchronize with the respective input source line.
    c. The UPS shall be provided with a temperature compensated internal oscillator, to automatically maintain the output load voltage frequency when the input source line voltage frequency exceeds specified limits.
    d. The rate of frequency change (slew rate) shall not exceed 0.1Hz per second.

D. Transient Voltage Surge and RFI/EMI Protection – (TVSS)

The UPS shall comply with the transient voltage surge and RFI/EMI electrical characteristics described below, when the UPS is operating in the Normal Mode, Emergency Mode, Recharge Mode or Bypass Modes.

1. Lightning and Transient Voltage Surge Protection, Electromagnetic Interference (EMI), and Radio Frequency Interference (RFI) Noise Filtering shall be provided for each UPS. The protection shall function during all UPS Operating Modes.
2. Provide EACH of the UPS source inputs and the load output of the UPS with lightning protection, transient voltage surge protection and EMI/RFI protection. The protection shall include functions for common mode and transverse mode; line-to-line (phase-to-phase); each line-to-ground (phase-to-ground); each line-to-neutral (phase-to-neutral) and neutral-to-ground connection protection configurations.
3. RFI and EMI
   a. Conducted line noises interference both EMI and RFI shall be reduced by the UPS over a continuous spectrum of 0.5 MHz to 1.0 MHz.
   b. The basis for reduction shall be a standardized 50 OHM insertion loss MIL –STD-220A Test.
   c. Provide spectrum analysis test, dB attenuation reports showing EMI and RFI filtering over specified frequencies. Test data that is based on calculated or computer simulation is not acceptable.
4. Voltage surge protection:
   a. Phase-to-phase and grounded "WYE" performance requirements

Characteristics	208/120 Volt
1) Nominal line to line	208 Volt
2) Nominal line to neutral	120 Volt
3) Internal capacitance Microfarads)	2.5
4) Maximum response time	1-nanosecond
5) Minimum EMI/RFI noise rejection	35-45 DB
6) Nominal peak clamp voltage line to neutral and line to ground	205 volts

   b. Minimum transient energy dissipation per phase (at 8 x 20 microseconds waveform): 1000 joules
   c. Peak transient withstand (at 8 x 20 micro-seconds wave-form) without failure of unit, ANSI C642.41: 50,000 amp
      1) Category-C3: 80,000 amp
      2) Category-B3: 60,000 amp
      3) Category-A3: 50,000 amp

E. UPS Short Circuit Withstand and Interrupt Ratings (bolted short circuit fault conditions, symmetrical and asymmetrical).

1. UPS line side input sources shall be "fully-rated" for the short circuit current available at the respective input sources of the UPS as described below, but in no case less than shown on the Drawings. "Series-Rated" with upstream devices is not acceptable for lineside input source devices:
   - 240 volts line-to-ground and below – 42,000 ampere RMS symmetrical.
2. UPS internal components shall be "Fully-Rated" or "Series-Rated" to the UPS line side input sources and the UPS load side output, but in no case, less than indicated on the Drawings, and not less than indicated in the time-current short circuit study submittal.
3. UPS load side output shall be "Fully Rated" or "Series-Rated" to the UPS line side input sources, but in no case less than indicated on the Drawings.

F. UPS DC Bus (Battery Source)

1. Maximum D.C. ripple with or without batteries connected to the D.C. Bus
   a. Voltage ± 0.4%
   b. Current 2% RMS
2. Battery voltage shall not vary beyond the following:
   a. Mutual D.C. bus battery shall not exceed 550 volts
3. The D.C. bus battery, end of discharge shutdown, shall be automatically adjusted by the UPS controls for partial UPS output load conditions, to allow for extended operation without damaging the batteries. Automatic shutdown based on discharge time is not acceptable.

4. Battery recharge time from full discharge to 95% recharge shall not exceed 15-times the UPS full load Emergency Mode operating time duration, when the UPS Input Source Load Limit is set at 130%.
5. An automatic battery equalize voltage charge shall initiate after the UPS returns to Normal Mode from any other operating mode. The override of equalize voltage and the time duration shall be adjustable from the UPS Control System.
6. The D.C. bus battery "float" charging voltage shall be automatically temperature compensated for the battery ambient temperature as monitored by the UPS.
   a. Approximate voltage adjustment range: ± 25 volt
7. UPS Load Testing of D.C. Bus
   a. Manually initiate from the UPS Control System a reduction of the D.C. bus battery charging voltage to approximately 1.9 volts per cell to force the D.C. bus batteries to carry the UPS load for a limited time.
   b. If a drop in battery voltage occurs indicating diminished battery capacity or battery failure, shall automatically cancel the test and "Alarm" the UPS Control System.

2.4 ENVIRONMENTAL OPERATING CONDITIONS (INCLUDING BATTERIES)

A. General
   1. UPS equipment shall maintain a full UPS load and performance without any derating of UPS operation resulting from the ambient conditions described below.

B. Ambient Conditions
   1. Normal ambient operating conditions:
      a. Temperature – 20 degrees to 30 degrees centigrade.
      b. Humidity – 30% to 90% non-condensing.
   2. Emergency ambient operating conditions:
      a. Temperature 0 degrees to 40 degrees centigrade.
      b. Humidity 5% to 95% non-condensing.
   3. Non-operating and storage conditions:
      a. Temperature – Minus 20 degrees to positive 50 degrees centigrade.
      b. Humidity – 0% to 95%

C. Altitude Normal Conditions
   1. Operate from sea level to 5,000 feet above mean sea level without derating.
   2. Non-operating and storage from sea level to 25,000 feet above mean sea level.
   3. Installation location of the UPS exceeding 5000 feet above sea level. The UPS kW and kVA output load ratings and DC Bus battery capacities shall be increased to compensate for the UPS altitude derating recommended by the Manufacturer, to maintain the specified output load capacities of the UPS.

D. Audible Noise
   1. Noise generated by the UPS under any condition of specified operation shall not exceed a sound pressure level measured at 5-feet from the nearest surface of the cabinet as follows:
      a. Shall not exceed 65dBA.

2.5 UPS ELECTRICAL CIRCUIT PROTECTION, DEVICES AND DISCONNECTS

A. Protection against External Events
   1. The UPS system shall incorporate built-in protection to prevent permanent damage to the UPS and to circuits extending external to the UPS for the following:
      a. Overvoltage, under voltage and overcurrent surges introduced by the primary UPS input sources.
      b. Overvoltage and overcurrent surges introduced on the UPS load output terminals by sources in the load, load switching and fault clearings in the distribution system of the load.
      c. RFI and EMF
      d. Transient voltage and lightning surges.

B. Protection against Internal Events

1. The UPS System (including the batteries) shall have built-in protection against permanent damage to itself and the connected load for all predictable types of failures within the UPS.
2. Protective devices shall be provided for power semiconductors, these devices shall be configured to prevent cascading failures.
3. The operation of any protective device shall be detected and displayed by the monitoring diagnostic system of the UPS Control System.

C. Input and Load Output Circuit Protection Devices

1. Device Types 100 amp and Greater Rating
   Multipole gang operated; time overcurrent circuit breakers with field adjustable internal solid state trip protection units, providing long time overcurrent/delay, short time overcurrent/delay and instantaneous current, trip element adjustable settings and electrical “shunt-trip” operation. Auxiliary annunciator and pilot relay contacts to indicate when the respective device is “Open-Closed-or Tripped”.
2. Device Types under 100 amp Rating
   Same as “100 amp or greater” requirements or alternately multipole gang operated molded case circuit breakers with fixed non-adjustable thermal-magnetic overcurrent trip elements, adjustable instantaneous trip elements and electrical “shunt-trip” operation. Auxiliary pilot, relay contacts to indicate when the respective devices is “open-closed-or tripped”.
3. Protection devices shall be rated for true RMS voltage operation with loads containing 100% THD harmonic voltage content.
4. Main circuit protection devices for UPS lineside input sources and for load side output shall be motor operated, to allow “on-off” switching control of the protection devices by the UPS Control System.

D. Provide a main circuit protection/disconnect device on each line side input source to the UPS and on each load side output of the UPS. Each device shall be rated for the UPS respective circuit, continuous 100% load ampere input/output rating.

1. Main normal utility source input.
2. DC bus battery input source.
3. Each feeder/branch circuit load output.
4. Maintenance bypass input source and load output.

E. Output Load Branch Circuit Protection

Provide individual branch circuit feeder load side output circuit protection devices for each load connection to the UPS shown on the Drawings. Each device shall be rated to supply the continuous 100% load ampere of the respective connected load without derating.

F. Emergency Power-Off Controls (EPO)

1. The UPS shall be provided with the means of turning off the UPS and disconnecting power to all the UPS input source(s) and the output load both locally and remotely.
   a. Locally - By a single operator switch.
   b. Remote - By the opening of an external customer supplied normally open or normally closed pilot relay contact.
2. Battery fused disconnect switches for manual on-off control of battery output, rated for battery disconnect ampere capacity.
3. UPS equipment “emergency-shutdown” pushbutton key/switch to shut down and disconnect from the UPS all input sources, shut down and disconnect all output loads from the UPS and shut down the entire UPS system. Locate shut down on the UPS equipment.
4. In addition to the UPS “emergency-shutdown” pushbutton located on the UPS, provide a remote UPS “emergency-shutdown” pushbutton for each UPS at each location shown on the Drawings, but in no case less than one remote pushbutton for each UPS, located at each door that provides access into the room occupied by the UPS.

G. Over Temperature Protection

1. Provide internal temperature sensors to monitor temperature of critical UPS components. Upon detection of temperatures in excess of Component Manufacturer's recommended ambient working temperature, the sensors shall cause audible and visual alarms to be indicated on the UPS Control Panel.

2.6 BATTERIES

A. Battery
   1. Storage battery unit(s) shall be furnished for the UPS with sufficient capacity to maintain 100% full load operational characteristics and duration in a 25 degree centigrade ambient temperature as specified herein, plus not less than a 5% spare reserve capacity.
   2. Battery cell caps shall incorporate hydrogen gas catalytic converter to reduce hydrogen out gassing during battery cycling.
   3. The batteries shall be the maintenance free sealed type.
   4. The battery containers shall be impact-resistant plastic. Each battery shall be designed for a 10-year life, when maintained under UPS full float charge operation as recommended by the Battery Manufacturer.
   5. The batteries shall comply with and be tested per ANSI-N45.2 and MIL-I45208A.
   6. The battery cell containers and covers shall be a flame-retardant material; all cells exceeding 0.25 kW per cell storage capacity shall include an integral flash arrestor.
   7. The battery load circuit connection terminals shall be rated for the UPS D.C. bus, Recharge Mode, Normal Mode and Emergency Mode operating voltage and current.
   8. Battery type:
      a. The battery cells shall be lead-calcium type characteristics, VRLA type.

B. Battery Cabinet
   1. All the cells making up the battery shall be installed in a freestanding cabinet, of the same construction as the UPS module cabinet. Battery shelves shall support and organize the batteries and D.C. wiring inside the battery cabinet. The cabinets shall all be of the same height and depth as the other UPS cabinets.
   2. Each battery cell shall be held in place to prevent movement during seismic event, as required for Seismic Earthquake Restraints at the location of installation.

C. Battery Disconnect Circuit Breaker
   1. Provide each UPS Unit with a DC-battery main circuit breaker. This circuit breaker shall be mounted between the battery output bus and UPS D.C. input bus. When the circuit breaker is open, there shall be no battery voltage present in the UPS module cabinet.
   2. The UPS Module shall be automatically disconnected from the battery by opening a motor operated circuit breaker or contactor, when the battery reaches the minimum discharge voltage level or when signaled by other UPS Control Functions.
   3. Disconnect shall be rated 600 volt D.C. operation, ampere rating equal to D.C. bus ampere rating and not less than 125% of the maximum DC Bus ampere flow.

D. All battery wiring shall be 600 volt insulated copper conductors.

2.7 CONTROL AND MONITORING

A. General
   1. All of the operator controls and monitors shall be located on the front of the UPS Module cabinet.
   2. Voltage, current, power, frequency and temperature parameters shall be measured and monitored using true RMS values, within $\pm$ 1% accuracy.
   3. Provide an annunciator lamp push-to-test button to test all annunciator lamps and audible alarms.

B. Controls
   1. The startup, shutdown and bypass operations shall be accomplished by a single control switch that will indicate when and in what direction the control switch should be turned.
   2. Pushbuttons shall be provided to display the status of the UPS. Pushbuttons shall also be provided to silence, test, set and reset visual and audio alarms.

C. Instrumentation for UPS Units
   1. The following alphanumeric digital metering/monitoring information shall be monitored and displayed. A high value alarm, low value alarm and pre-alarm set points shall be field programmable for each metering/monitoring value and maintained in non-volatile UPS storage

memory for recall display from memory. Analog to digital converters, current transformers and potential transformers for each instrumentation function shall be provided as part of the UPS system.

2. Each input source and the load output AC-voltage, AC-amperes and total harmonic distortion, line-to-line and line-to-neutral for each phase for:
   a. UPS module.
   b. Each UPS bypass unit.
3. Each input source and the load output-AC power factor, load capacity percentage; AC-frequency, AC-KW and AC kVA for:
   a. UPS module.
   b. Each UPS bypass unit.
4. DC battery bus:
   a. Battery operating capacity and remaining capacity during battery operation.
   b. Total UPS operating time of DC Bus source battery.
   c. DC voltage and ampere.

D. Status and Alarms for UPS Units

1. The following alarms shall be displayed, an audible alarm shall activate when any of the following alarms occur. A visual alphanumeric display or pilot light annunciator shall display each condition. The time, date and duration for each status and alarm shall be maintained in non-volatile UPS storage memory, for recall display from memory. Analog to digital converters, sensors and transponders to sample and monitor each condition shall be provided as part of the UPS system.
2. Power-On, Power-Off and Power-Failed for each input source and load output (AC and DC sources).
3. DC bus
   a. Battery discharging.
   b. Low/high DC Bus voltage.
   c. DC Bus ground fault.
   d. Low battery reserve shutdown.
   e. DC Bus batteries disconnected.
4. UPS loss of synchronization.
5. Temperatures
   a. Equipment over temperature; pre-alarm shutdown.
   b. Over temperature shutdown.
   c. Cooling fan failure.
   d. Battery over/under temperature.
6. UPS Control Power failed.
7. Each source input and load output:
   a. Over, under voltage and loss of voltage.
   b. Over and under frequency.
   c. Overload warning and shutdown.
8. UPS circuit breakers and circuit protection devices disconnect or fuse open.
9. Rectifier/charger failure.
10. Each UPS Bypass Mode:
    a. Load operating on bypass.
    b. Bypass input source not available/disconnected.
    c. Bypass disabled.
    d. Incorrect Bypass phase sequence.
    e. Bypass input source and load output not synchronized.
    f. Bypass disconnected from the load output.

E. Mimic Panel

1. The mimic panel shall depict a single line diagram of the UPS. Indicating lights shall be integrated with the single line diagram to illustrate the status of the UPS Power paths. The functions whose status is to be displayed shall include, but not be limited to, the following:
   a. Each input sources power available.
   b. Output load power available.
   c. Normal operation.

d. Bypass operation.

2.8 EQUIPMENT DETAILS

A. All Materials and Parts comprising the UPS shall be new, of current Manufacturer, of a high grade and free from all defects and imperfections that may affect UPS correct operation and shall not have been verified in prior service, except as required during factory testing.

B. All Active Electronic Devices shall be solid state. All semiconductor devices shall be hermetically sealed. All control relays shall be dust tight, visible contact position, “socketed” plug-in type.

C. The Maximum working voltage, current and “di/dt” of all solid state power components and electronic devices shall not exceed 75% of the ratings established by the respective Manufacturer. The operating temperature of solid state component cases shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 90% of their voltage rating.

D. Wiring
   1. Access holes with removable coverplates shall be provided on the top, bottom and sides of the UPS and battery cabinets for inter-cabinet wiring and customer installation wiring connections.
   2. All bolted connections of bus bars, lugs and cables shall be in accordance with requirements of the National Electric Code and other applicable Standards. All electrical power connections shall be torqued to the required value and marked.
   3. Provide conductor connection lug landings for lineside input sources, load side output and control system conductor connections to the UPS. Quantity and sizes of conductor lug landings to match circuit conductors and ratings shown on the Drawings.
   4. All energized terminals and conductors landing/lugs shall be insulation shielded to ensure that Maintenance Personnel do not inadvertently come into contact with energized parts or terminals.
   5. Wire runs shall be protected in a manner, which separate and isolate power from control wiring. Provisions shall be made in the cabinets to permit installation of input, output, and inter-cabinet cabling, using raceway or conduits.
   6. Bus for AC line/load voltage current and bus for D.C. current shall be copper; maximum 800 amp per square inch current density based on 100% non-linear loading; continuous extruded insulation over bus with removable insulation “boots” at all screw/bolted bus connections. Bolted connections shall employ “spring-lockwashers”. Silver-plating of bus at all connection locations.

E. UPS Cabinet Housing
   1. The UPS shall be contained in NEMA Type I metal enclosures, with key locking hinged metal access doors.
   2. Enclosures exceeding 400 pounds shall be anchored to the floor, held in place to prevent movement during seismic event, as required for Seismic Earthquake Restraints at the location of installation.
   3. The UPS housing shall be suitable for mounting on a concrete floor or carpeted floor.
   4. The UPS shall be structurally reinforced with provisions for hoisting, jacking and forklift handling.
   5. UPS cabinet housing segregation:
      a. Provide separate cabinet(s) for each UPS modules, bypass modules and battery modules for UPS units.
   6. The UPS cabinets shall be cleaned, primed, and painted with the Manufacturer's standard colors.
   7. Adequate forced air ventilation flowing through each UPS cabinet shall be provided to insure that all components are operated within their environmental ratings.
      a. All ventilation fans shall be equipped with “wind- vane” sensors connected to an alarm annunciator on the UPS control system.
      b. Provide removable replaceable air filters on air-cooling, air-intake vents on UPS units with internal cooling fans. Fans shall be redundant operation.

2.9 REMOTE ANNUNCIATOR PANEL

A. General
   1. Provide a self-contained wall mounted remote annunciator panel to provide individual indication of the UPS Status and Alarm conditions.
   2. The annunciator shall be alphanumeric display.
   3. Provide pushbutton to silence the audio alarm with automatic resound.
   4. Annunciator shall be flush or surface mount as indicated on the Drawings.

B. Status and Alarm Conditions
   1. The remote annunciator shall display the same monitoring, status and alarm information for each UPS as the UPS Control System.
   2. The remote annunciator panel shall provide remote control of the UPS from the annunciator panel with operator “password” authorization protection.

2.10 NETWORK COMMUNICATION

A. Communication Interface
   1. The UPS shall communicate with the facility computer/data network. Provide Simple Network Management Protocol (SNMP) latest revisions and Management Information Base Protocol (MIBP) latest revisions. The UPS SNMP Agents shall comply with Internet Engineer Task Force IETF-RFC1628 basic and advanced levels standards, compliant software with multi-user site license. The software shall provide computer data network communication.
   2. UPS internal network interface card shall provide compatible connection to the network installed at the computer data UPS connection location for "inband" network communication.
   3. Provide "out-of-band" communication through RS-232 or USB modem port connection.
   4. Communication ports shall be based on EIA/TIA – 568B Standard connections 100 BASE-T copper wire and multi-mode fiber optic communication links.

B. The software shall operate on each network server and computer workstation node to provide the following monitoring and control functions:
   1. Automatic unattended shut down of multiple network servers and multiple stand-alone systems, to prevent data loss after failure of the normal power source and prior to exhaustion of UPS battery storage capacity. Automatically save all data to hard disk drives.
   2. Automatic reboot of equipment connected to the UPS power outputs, upon restoration of normal utility power.
   3. Notification of normal power loss with broadcast messages to all network connected nodes.
   4. Automatic logging of power events to the network servers and workstations and UPS internal event storage memory.
   5. Software customizable network shut down and auto boot command sequences, with manager password protection.
   6. Provide an internal database of equipment connected to the UPS and provide variable delayed shut down duration of each connected unit.

C. Install and customize the UPS Software on the Network Servers’ workstations, standalone equipment and UPS Equipment Control System.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation of the UPS shall be in full accordance with UPS Manufacturer's recommendations. Set and calibrate all adjustable settings as recommended by the UPS Manufacturer. Install and connect the UPS to the input sources and load output circuits.

B. Transparent Temporary Protective Plastic Covers of suitable gauge shall be provided during installation of the UPS System to protect the entire UPS Equipment from dust and dirt at all times, except while working on a given module, after which the plastic covers shall be reinstalled. Remove temporary covers prior to placing UPS in operational service.

C. Anchor the UPS Cabinet(s) to the building floor and walls and equipment racks as applicable to hold in place to prevent movement during seismic event, as required for Seismic Earthquake Restraints at the location of installation.

D. UPS Communications
   1. Provide complete, copper wire computer data workstation outlet box, and outlet at each UPS location. Provide 0.75 inch conduit with two Category-6A, 4-pair STP twisted pair network data cables complying with EIA/TIA-568B, homerun to nearest computer/data network equipment rack patch panel, or computer data network terminal room closet from each UPS. Provide plug-in RJ-45 connection of UPS to computer data network outlet.
   2. Provide outlet box at each UPS and empty 0.75 inch conduit homerun to nearest telephone backboard from each UPS for voice telephone connection to UPS Controls.
   3. Provide outlet box at each UPS and two 1.25 inch conduit with conductors recommended by UPS Manufacturer, from UPS to each respective remote UPS Annunciator/Control Panel.
   4. Provide outlet box at each UPS and 0.75 inch conduit with 4#14 to each remote EPO.
   5. Install, set-up and test UPS Communications Network and Control Software.

3.2 TESTING AND COMMISSIONING

A. General
   1. UPS equipment and batteries shall be inspected for damage as soon as they are received. Specifically check to see if wet cell batteries have been turned over in shipment and whether the equipment cabinets have received any severe dents which might cause internal damage. Remove and replace all damaged equipment with new undamaged equipment.
   2. Use only the factory provided knock-out areas and conduit entry provisions on the equipment for wiring. Care shall be taken not to let metal slugs or chips get into the equipment cabinet.
   3. Prior to energizing equipment, perform measurements on the incoming and load output AC lines to the equipment to insure that the proper voltage level is available and that there are no ground faults or high potentials between conductors or between phase conductor to neutral/ ground.
   4. Prior to installing the fuses, or closing the circuit breaker in the battery circuit, verify correct battery voltage, polarity markings, battery electrolyte level and all electrical connections are secure.
   5. Prior to turning the system on for any tests, the unit shall be bypassed with the mains connected to feed the load directly and the currents in each conductor measured and balanced. Follow Manufacturer's instructions for installation, connection and energizing equipment.
   6. Batteries which are shipped with the electrolyte in the battery cells shall be maintained on a float charger when not installed and energized, operating in the UPS Unit. Batteries shipped without electrolyte installed in the battery cells shall not have electrolyte added until equipment is installed and ready to be energized. Batteries which are not handled with this procedure will be rejected, shall not be used and shall be replaced with new batteries at the Contractors expense.
   7. Provide Factory Authorized Field Service Technician factory start-up to Inspect, Energize, Test and Certify the correct system installation, connections and operation. Provide written acceptance Field Service Report, six copies, to Owner's Representative.

B. Provide Full UPS Output Load Capacity and voltage capacity temporary inductive test load banks, 80% power factor and perform full load testing of the UPS after the installation is complete and prior to energizing the building system load circuits connected to the UPS. The UPS shall be cycled through two complete charges and discharge cycles with the UPS connected to the temporary load bank. Remove the temporary UPS load bank and complete UPS connections after the successful completion of the UPS Verification and of the UPS Compliance with the Contract Document Testing, Performance Requirements.

C. Commissioning (Additional Requirements)
   1. Setup, Testing, Startup, and Commissioning shall be performed by Factory Technician(s) Trained, Certified and Authorized by the Equipment Manufacturer. Final Commissioning shall be performed after installation and connections are complete.

2. Provide system programming and setup of all control sequences for the UPS Operation and Control System.
3. Simulate normal source power failure by opening (turn-off) building main service disconnect and verify connections and operation of each electrical system device connected to the system on both normal power source and emergency power sources.
4. Record and document electrical demand load and sequence of operations on the UPS System with all connected loads operating.
5. Test all control system functions after the installation and connections are complete and the system has been energized. Verify each control sequence of operation and each device to be controlled are each operating correctly.
6. Record and document each device setup and program setting.
7. Submit written report (six copies) to Owner's Representative Certifying Commissioning has been performed; all respective systems are operating correctly and document all software setup and each device setting.

3.3 FACTORY SERVICE AGREEMENT (FIRST TWO YEARS OF OPERATION) *ADD 2*

A. General

1. Provide site visits and written reports for each UPS at unit start-up, commissioning, and again approximately 12 months after completion of testing and commissioning and again 12-months from there. Shall be included as part of the Base Contract Scope. *ADD 2*
2. Factory Authorized Technician shall visit site and startup-test all UPS Options, Accessories and Functions, Physical, Electrical and Mechanical Inspection. Simulate normal source power outage and recharge functions.
3. UPS factory remote monitoring and reporting of each UPS Status, using LAN-Network and/or telephone communications line provided by the Owner.
4. The Base Contract initial ~~first~~ 2-year-operation Service Scope shall be renewable, if mutual agreement between the UPS Manufacturer and the Owner is accomplished for service cost, scope and renew. *ADD 3*
5. Provide three copies of Factory Service Proposal renew Agreement to the Owner's Representative.

END OF SECTION 263353
062117/1010006

SECTION 272000
DATA COMMUNICATIONS ACTIVE INFRASTRUCTURE

Revised, Addendum #3, 09/22/17
Added, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section describes the data communications network infrastructure including electronics and software needed to support Local Area Networks and Network Management.

B. Products Installed Under this Section: Only new equipment and material, produced by Manufacturers that are recognized nationally by the telecommunications industry and approved by Underwriters Laboratory shall be used as specified in this Section or on the Drawings.
   1. All mounting hardware
   2. All mounting brackets
   3. All power cords

C. Related Sections:
   1. Division 01
   2. Section 230913: Building Management System
   3. Section 260500: Common Work Results for Electrical
   4. Section 265000: Lighting
   5. Section 272126: Structured Telecommunications Cabling and Pathway System
   6. Section 273226: Emergency Phones
   7. Section 274116: Integrated Audio-Video Systems and Equipment
   8. Section 281300: Access Control
   9. Section 282300: Video Surveillance

1.2 REFERENCES

A. NEMA – National Electrical Manufacturer's Association

B. ANSI – American National Standards Institute

C. NEC – National Electric Code

D. RSEF – Relevant State Electrical and Fire Codes

E. IEEE – Institute of Electrical and Electronic Engineers

F. UL – Underwriters Laboratories, Inc.

G. ANSI/EIA/TIA – 568A-1995 Commercial Building Telecommunications Wiring Standard.

H. ANSI/EIA/TIA – 568-B-2-1 Transmission Performance Category 6 Cabling Specifications for 4-Pair 100 Ohm.

I. ANSI/EIA/TIA – 569A Commercial Building Standard for Telecommunications Pathways and Spaces

J. ANSI/EIA/TIA – 606 The Administration Standard for the Telecommunications Pathways and Spaces

K. ANSI/EIA/TIA – 607 Commercial Building Grounding and Bonding Requirements for Tele-communications

L. ANSI/EIA/TIA – 598 Color Coding of Optical Fiber Cables

M. EIA/TIATSB – 67 Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

N. BICSI – Building Industry Consulting Service International publications:
   1. Telecommunications Distribution Methods Manual
   2. LAN and Internetworking Design Manual
   3. Telecommunications Cabling Installation Manual
   4. Customer Owned Outside Plant Design Manual
   5. Manufacturer's recommendations and installation guidelines

O. All Cabling shall comply with all appropriate requirements of NEC Articles 770 and 800 and shall comply with the State Fire Codes as interpreted by the State Fire Marshall's Department.

P. All Publications referred to in this document shall be the latest publicized edition.

1.3 SUBMITTALS

A. Product Data
   1. Provide a list of complete current part numbers, product revision levels and confirm with District ITS during submittal phase. ***ADD-3***
   2. If additional equipment is required to meet Performance Specifications of the system, Contractor shall provide the equipment with District ITS written approval prior to installation. ***ADD-3***

B. Certificates
   1. Contractor shall carry the appropriate Manufacturer Certification for installation of the Data Communications and Wireless Equipment.
   2. Contractor shall provide Proof of Certification to the District.

C. Qualifications
   1. Contractor shall provide proof of training / certification to the District. The Installing Contractor must be certified with the Manufacturer for at least twelve (12)**-** months prior to the bid. ***ADD-3***
   2. Contractor shall assign competent person as Project Manager who has demonstrated the ability to supervise a project of similar size and scope. Submit a resume of the proposed Trade Contractor Project Manager for the District's review and acceptance. The Project Manager must attend meetings as required.
   3. Contractor shall provide documentation to the District to demonstrate that it has been in the telecommunications contracting business for a minimum of 5-years under the same name and are located within a 4-hour response time of the District.
   4. Installer shall include BICSI Cabling Installer Certifications for all cabling being installed.

1.4 CLOSEOUT SUBMITTALS

A. Contractor shall provide published escalation and priority handling procedures. This shall include the names and phone numbers, in organizational chart format, of the Technicians and Management responsible for supporting the District.

B. Contractor shall describe its policies and plans to assist the District in the event of a catastrophic disaster to the facilities mentioned in this Section.

C. Contractor shall provide a port map indicating all port locations. The port map shall show the Wall Label and Floor Plan location for each data jack.

D. Warranty and Performance Agreements.

1.5 QUALITY ASSURANCE

Use adequate numbers of skilled workers thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver Materials (except bulk materials) in Manufacturer's unopened containers fully identified with Manufacturer's name, trade name, type, class, grade, size and color.

B. Store Materials in unopened containers. Store off ground and under cover, protected from damage.

~~C. Deliver Materials to the District~~ ***ADD-3***

~~1. Provide "Letter of Acceptance" to be signed by District Project Manager, and Project Inspector.~~ ***ADD-3***

~~2~~C. Materials to be delivered to District not less than 2-weeks prior to Contractor's scheduled installation date. ***ADD-3***

1.7 PRE-INSTALLATION MEETING

Schedule a pre-installation meeting with Architect, District Project Manager, District ITS Representative, and Contractor in attendance.

1.8 WARRANTY

A. Manufacturer Warranty:
   1. ~~MDF/~~BDF switch electronics: LAN electronics and associated software include a ~~1~~2-year Manufacturer Warranty for non-core gear. Core gear shall include a 5-year Manufacturer Warranty. ***ADD-3***
   2. IDF switch locations: LAN electronics and associated software shall be warranted for ~~1~~2-year with full service materials and labor.
   3. All other products shall include the Standard Manufacturer Warranties.

B. Contractor Warranty:
   1. Contractor shall provide installation warranty extending to the Data Communications Active Infrastructure protecting RSCCD against defects in workmanship for a minimum period of 2-years from the date of system acceptance. Such warranty shall provide all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within original Specifications after the repairs are accomplished.
   2. Contractor shall be available 24-hour/7-day-per-week for on-site service to correct defects in installation~~,~~ or workmanship~~, product failure, or material~~ without charge for labor, materials or parts. ~~All major c~~Component failure~~s must~~ be ~~replaced within a 4-hour period~~addressed directly with the manufacturer through the provided manufacturer warranty; however issues related to product failure due to faculty or improper installation or workmanship by the Contractor shall be resolved by the Contractor. ~~A major component shall be considered any hub or switch component that affects fifty (50) or more user devices.~~ ***ADD-3***
   3. Response time is defined as on-site presence of authorized Maintenance Personnel equipped with appropriate spare parts and diagnostic tools.
   4. Once work has begun on repair of a critical problem, a technician shall remain on-site until the problem has been repaired. Contractor shall be allowed to change Technicians at shift changes, however, the first Technician shall not leave the site until the second has arrived and has been briefed on the problem.

~~5. Contractor shall provide the District with the Manufacturer toll-free hotline and support center to assist the District Personnel in the installation, tuning, maintenance and updating of the systems hardware and software. **ADD-3**~~

~~6~~5. If parts are required to fix a critical problem that is not available locally, they shall be shipped by the fastest possible means at no cost to the District. ***ADD-3***

~~7~~6. During the warranty period, Contractor shall keep on-site detailed maintenance and repair records of all calls made to the facility. ***ADD-3***

PART 2 PRODUCTS

2.1 LAN ELECTRONICS

A. ~~A.~~ All Equipment is to be certified new ~~and Certified by~~ Brocade for network switches and Aruba for wireless access points. ***ADD-3***

B. No refurbished, used, after-market or gray-market components will be accepted. ***ADD-3***

C. ~~B.~~ Contractor will be responsible for all mounting kits and brackets for the LAN electronics and Wireless equipment. ***ADD-3***

D. ~~C.~~ No refurbished, used, after-market or gray-market components will be accepted. ***ADD-3***

E. ~~D.~~ Material must be rack mountable in the equipment racks as specified in Section 271000 Structured Cabling. ***ADD-3***

~~A. E. The System is required to operate 24 hours/day, 7 days/week. At a minimum, the system is required to have an uptime of 99% for any single switch component during the hours of 7:00 a.m. to 7:00 p.m. (and 98% uptime when calculated over a 24-hour day). **ADD-3**~~

F. ~~F. MDF/~~BDF Switches ***ADD-3***

1. Redundant power supplies (2x500W) part number RPS9+E and redundant tray fans (1x ICX7750-FAN-E – kit of four) shall be provided for each switch.
2. Redundant core s~~S~~witches, one pair, shall be Brocade, Model ICX7750-48F or most current replacement part number or equivalent Brocade technology model and software version. Confirm with District ITS Department prior to purchasing. ***ADD-3***
   a. Premium licensing to accomplish Layer 3 features. ***ADD-3***
   b. ~~Associated~~ Two (2) 10 GE SFP's ~~as required depending on application~~per core switch shall be provided to create redundant uplinks to the IDF stacks. ***ADD-3***
   c. Use i~~I~~nterconnect / stacking cables, p~~ as required depending on application. P~~art number 40G-QSFP-QSFP-C-0101 ***ADD-3***
   ~~d. When used as a core device, provide a minimum of two switches for stacking. **ADD-3**~~
3. Contractor shall verify the correct components and correct amount of components.

G. ~~G.~~ IDF Switches ***ADD-3***

1. Stack switches. Provide additional SFP direct attached copper cables; 1M, 3M, or 5M length as required.
   a. Use Brocade Model ICX7150-48PF-2X10G or most current replacement part number. Confirm with District prior to purchasing. ***ADD-3***
   b. ~~Exterior locations Layer II managed 48 port POE switch with SFP modules; manufactured for exterior locations. **ADD-3**~~
   ~~c.~~ Contractor shall verify the correct components and correct amount of components for a complete and fully operable system. ***ADD-3***

H. ~~H.~~ Provide a Central UPS system at ~~MDF/~~BDF to connect to the IDFs per the following: ***ADD-3***

1. UPS and battery pack sized to provide minimum 1-hour uptime at full utilization including POE.
2. Rack mount-kits for UPS and battery packs.
3. Ethernet Network Interface Card with SNMP capabilities for remote monitoring.
4. Contractor shall verify the correct components and correct amount of components for the ~~MDF/~~ BDF, and each of the IDFs. ***ADD-3***
5. Contractor shall verify the correct components and correct amount of components for a complete and fully operable system.

2.2 WIRELESS ACCESS POINTS AND ACCESSORIES

A. Manufacturer: Aruba Networks, District Standard – no or equals
   1. Indoor – Aruba 320 Series
      a. Part No. JW186A (AP-325 802.11n/ac 4x4:4 MU-MIMO Dual Radio Integrated Antenna AP)
   2. Outdoor – Aruba 270 Series
      a. Part No. JW178A (AP-275 802.11n/ac Dual 3x3:3 Radio Integrated Omni Antenna Outdoor AP).
      b. Part No. JW180A (AP-277 802.11n/ac Dual 3x3:3 Radio Integrated Directional Antenna Outdoor AP).
   3. Mounting Kits
      a. Part No. JW054A (AP-270-MNT-H1 AP-270 Series Outdoor AP Hanging or Tilt Install Mounting Kit).
      b. Part No. JW055A (AP-270-MNT-H2 AP-270 Series Access Flush Wall or Ceiling Mount)
      c. Part No. JW052A (AP-270-MNT-V1 AP-270 Series Outdoor Pole/Wall Long Mount Kit)
      d. Part No. JW053A (AP-270-MNT-V2 AP-270 Series Outdoor Pole/Wall Short Mount Kit)
      e. Part No. JW047A (AP-220-MNT-W1W Flat Surface Wall/Ceiling White AP Basic Flat Surface Mount Kit).

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Contractor shall hold a pre-installation meeting with District Project Manager and ~~RSCCD~~ District ITS Representative. ***ADD-3***

B. Property Damage caused by Contractor during the installation and testing process shall be replaced at no cost to the District.

C. Contractor will be responsible for all mounting kits and brackets for the LAN Electronics and Wireless equipment.

~~D. Contractor will be responsible for providing and patching ALL fiber and copper data cables into LAN Electronics, CCTV, and Wireless equipment in coordination with RSCCD ITS Department. No ports shall be patched without prior consultation with RSCCD ITS Department.~~ ***ADD-3***

3.3 LOCATIONS

A. Coordinate with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of Governmental Agencies Having Jurisdiction, and the

Manufacturer's recommended installation procedures as approved by ~~RSCCD~~ District Project Manager, anchoring all components firmly into position for long life under hard use. ***ADD-3***

3.4 GENERAL INSTALLATION REQUIREMENTS

A. Contractor shall provide a full suite of installation services and a turnkey solution. Specifically, this includes:
   1. Contractor shall submit a short written report on a weekly basis to the District Project Team. This report should contain the following information:
      a. Summary of work completed for the week concluded.
      b. Summary of work anticipated for the following week.
      c. Any action items requested of the District Project Manager or District ITS Personnel.
      d. Any deviations from the implementation schedule. ***ADD-3***
   2. Turnkey installation is defined as having all networking components including cabling, and LAN/WLAN electronics, mounting hardware, firmware working as individual components as well as a homogenous system.
   3. Contractor will coordinate installation schedules with the District Project Manager so as to minimize the impact on day-to-day operation for the campus.

3.5 LAN ELECTRONICS INSTALLATION

A. Contractor shall deliver network switches and configurable components to the District ITS Department prior to installation. Timing of this should be coordinated with the District ITS Department so that equipment arrives for configuration "just in time." District ITS will coordinate with Contractor to attend to any DOA equipment that may arrive on site. ***ADD-3***

B. ~~A.~~ The District shall configure ~~each~~ all WAPS and switches with the appropriate TCP/IP address and District configuration prior to Contractor installation. ***ADD-3***

C. ~~B.~~ Contractor shall install switches per BDF/IDF as assigned by ~~RSCCD~~ District ITS Department. ***ADD-3***

~~—~~Contractor shall coordinate with District ITS Department to connect the SNMP network interface card of the ~~C. Contractor shall include topology of switches/stacks in each MDF/BDF/IDF.~~ ***ADD-3***

D. ~~D.~~ BDF UPS Power Supply ~~shall include an SNMP card,~~to the access layer network, which will enable the District ~~capable of~~ to notify~~ing~~ at minimum the following items: ***ADD-3***
   1. When utility power is lost and unit is running on battery backup;
   2. Over and under voltage;
   3. Battery issues;
   4. Battery age; and
   5. Unit operating temperature.

~~A.~~E. ~~E.~~ Access Layer ~~Fast~~ Gigabit Ethernet (~~100BaseTX/~~1000BaseTX) PoE Switches will be located in each closet supporting interfaces to switched 100BaseT Ethernet and switched 1000BasetT ~~Fast~~ Ethernet ~~to~~ at station devices. ***ADD-3***

~~B.~~F. ~~F.~~ All Unshielded Category 6 Twisted Pair (UTP) wiring will connect access layer switches to the station devices (PC's, printers, etc.) All 100BaseTX/1000BaseTX interfaces will be 8-pin modular (RJ-45) type. ***ADD-3***

~~G. All Gigabit interfaces to the core switch will be fiber optic.~~ ***ADD-3***

G. ~~H.~~ At full utilization, including POE, each UPS will include the appropriate extended run battery(s) capable of supplying 60 minutes of power.

H. District ITS will perform all the cable cross-connect and station patching tasks. ***ADD-3***

3.6 WIRELESS INSTALLATION

A. Wireless Controllers are existing.

B. Install new WAPs and mounting hardware as indicated in the Drawings.

3.7 ACCEPTANCE TESTING

A. All LAN and WLAN Electronics specified in this document must meet Manufacturer's standard tests. ***ADD-3***

~~Testing must include identification of VLAN/IP address per port.~~ ***ADD-3***

B. Device Configurations must be reviewed and approved by the District before deployment in production environment to allow for changes and acceptance.

C. Contractor shall perform a detailed post-install passive site survey for coverage and capacity validation. ***ADD-3***

D. Contractor shall prepare detailed coverage heat maps, after the installation of the WAP's, using AirMagnet Wi-Fi Pro, AirMagnet Survey Pro or equal approved by the District Project Manager. ~~Predictive site surveys are not acceptable such as utilizing Cisco LMS software.~~ Provide current certifications for the site surveyor for AirMagnet or District approved equal. Provide a copy of the physical survey to District Project Manager prior to installation of Wireless Access Points ("WAP"). Heat maps shall identify: ***ADD-3***

1. Access point quantity
2. Access point locations (room and building)
3. Access point protocol 802.11 g/n/ac
4. Access point channel and signal strength
5. Common access point configuration
6. Seamless subnet roaming
7. Non 802.11 interference in 2.4GHz and 5GHz bands
8. Special antenna
9. Physical end environmental requirements for access point placement
10. Upgrades to existing access points (including hardware and/or software)

3.8 PROJECT RECORD DOCUMENTATION

A. Prepare and Submit electronic copies of As-Builts and ~~Logical Network~~ Layer 1 network ~~D~~diagrams updated to reflect the new work completed for project (i.e. Site Plans, cable, pathways, ~~MDF/~~BDF/IDF cabinet elevations, equipment spreadsheets, an~~etc.~~d wireless heat maps). ***ADD-3***

B. These Documents must be delivered to the District Project Manager upon completion of work and before Final Inspection.

END OF SECTION 272000
081517/1010006

SECTION 274116

INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

REVISED. ADDENDUM #3. 09/22/2017
REVISED, ADDENDUM #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. Provisions of Division 1 apply to this section.

B. Section Includes
   1. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up, and testing of the Audio, Video and Control Systems work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, working systems. General design intent for this project is shown on the drawings and described in the specification.
   2. All equipment requiring coordination with other trades must be tested and verified for proper operation. Contractor is fully responsible for the coordination and must resolve all conflicts with AV equipment that connect or interact with other systems.
   3. Design, engineer and provide complete means of support, suspension, attachment, fastening, bracing, and seismic restraints (hereinafter "support") of the Work of this Section, including future installed equipment, in accordance with local building codes and regulations. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction. Contractor shall obtain the services of an engineer licensed to perform this work within the state or jurisdiction it is to be performed.
   4. The Contractor shall include all costs associated with structural engineering required by code for work in this section.
   5. Use skilled mechanics that are capable of returning surfaces to the appearance of new work when modifying millwork.
   6. Conduit and common back boxes including four square, pull boxes, junction boxes, etc. are supplied and installed by Division 26 Electrical Contractor. Connection panels that install in these boxes are supplied by AV Contractor.
   7. Provide Power Over Ethernet switches and injectors where required.
   8. Provide all cable and wire associated with this specification section and related documents.
   9. All systems shall be completely installed with all of the necessary interconnection, power supplies, patch cords, snakes, portable equipment cables and wiring to provide a fully functioning system.
   10. The governing overall requirement for this project is a complete and functional system.
   11. Include work not usually shown or specified, but necessary for proper installation and operation of the system or piece of equipment.

C. Products Supplied But Not Installed Under This Section
   1. Loose equipment or products supplied but not installed shall be turned-over to the Owner immediately upon delivery. Contractor is to supply a signed statement of transfer of this equipment to the consultant for record. Client must sign this statement acknowledging receipt of this equipment.
   2. Specialty floor boxes, back boxes including but not limited to Crestron, AMX, Extron, FSR, Steel City and speaker back boxes shall be provided to the General Contractor for installation.

~~D. Products Installed But Not Supplied Under This Section~~
   ~~1. Owner Furnished and existing equipment as shown on drawings.~~ **ADD 2**

~~E.~~D. Related Sections **ADD 2**

1. 019113 – General Commissioning Requirements
2. Division 9.
3. Division 10.
4. Division 11.
5. Division 26.

~~F.~~E. Measurement Procedures **ADD 2**

1. Product quantity is as required. If a quantity is given, the Contractor will provide at least the given amount. Some products listed under this section may not be required to fulfill the obligations of the work.

1.2 REFERENCES

A. Comply with all applicable governing codes.

B. Comply with the following applicable organizations and standards:

1. AES Audio Engineering Society
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials
4. BICSI Building Industry Consulting Service International, Inc.
5. BTSC Broadcast Television Stereo Committee
6. CEDIA Custom Electronic Design and Installation Association
7. EIA Electronic Industries Alliance
   a. RS-310-C: (ANSI C83.9) Racks, Panels, and Associated Equipment
   b. RS-453: Dimensional, Mechanical, and Electrical Characteristics Defining Phone Plugs and Jacks
8. ETL Electrical Testing Laboratories, Inc.
9. FCC Federal Communications Commission
10. ICIA International Communications Industries Association
11. IEC International Electrotechnical Commission
12. IEEE Institute of Electrical and Electronic Engineers
13. INCITS InterNational Committee for Information Technology Standards
14. ISO International Organization for Standardization
15. ITU International Telecommunications Union
16. NAB National Association of Broadcasters
17. NCTA National Cable and Telecommunications Association
18. NEC National Electrical Code
19. NEMA National Electrical Manufacturers Association
20. NFPA National Fire Protection Association
21. NSCA National Systems Contractors Association
22. OSHA Occupational Safety and Health Administration
23. SMPTE Society of Motion Picture and Television Engineers
24. TASO Television Allocation Study Organization
25. TIA Telecommunications Industry Association
26. UBC Uniform Building Code
27. UL Underwriters Laboratories Inc.

1.3 DEFINITIONS

A. Definitions of Terms: The following definitions and conditions apply to each of the respective parameters and the measurements of those parameters, unless specifically stated otherwise:

1. Frequency Response: The minimum acceptable frequency band over which the amplitude response is within 3 dB (or any specified range), or the specified limits of the response relative to the reference frequency (1 kHz for audio, 1.0 MHz for video) under design load conditions, at any operating level up to and including the specified maximum output while fully in compliance with all other performance specifications.
2. Maximum Output Level: The minimum acceptable maximum signal output level (voltage, current or power) attained under design load conditions attained while fully in compliance with all other performance specifications.
3. Harmonic Distortion: The maximum acceptable harmonic distortion measured at any operating level, up to and including the specified maximum output, with an applied sine wave signal of any frequency in the range of the specified frequency response.
4. Audio Intermodulation Distortion: The maximum acceptable intermodulation distortion resulting from the introduction of 60 Hz and 7 kHz signals in a ratio of 4:1 under design load conditions at any operating level up to and including the specified maximum output level.
5. Signal to Noise Ratio: The minimum acceptable ratio of signal to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.
6. Clipping Level: The minimum acceptable maximum level of signal applied to the device under design load conditions while fully in compliance with all other performance specifications.
7. Sensitivity: The maximum acceptable level of input signal applied to the device that is necessary to provide the maximum output under design load conditions.
8. Design Load: The load (in ohms) specified by usage of the particular device input or output.

B. Signal Levels: The following voltage levels shall be considered the standard operating levels for the particular circuitry, unless specifically noted otherwise (0.775 Volt = O dBu = O dBm for a 600 ohms terminated circuit):
   1. Microphone Circuits: -30 dBu or less.
   2. Audio Line Level Circuits: -30 dBu to +24 dBu; equivalent to -30 dBm to +24 dBm for a 600 ohms terminated circuit.
   3. Loudspeaker Level Circuits: More than +24 dBu.
   4. Video Line Level Circuits: 1.0 Volt, peak to peak composite signal.

C. Characteristic Impedances: The following operating impedances shall be considered to be the standard operating impedances for the particular circuitry, unless specifically noted otherwise:
   1. Microphone Circuits: 50-250 ohms source, 150-1500 ohms terminating, electrostatically and electromagnetically balanced to ground.
   2. Audio Line Level Circuits: 600 ohms maximum source, 600 ohms minimum. terminating, line to line, electrostatically and electromagnetically balanced to ground.
   3. Video Line Level Circuits: 75 ohms maximum source, 75 ohms minimum terminating to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

1.4 SYSTEM DESCRIPTION

A. Design Requirements
   1. General
      a. The Santa Ana Science Center audio-visual system includes Classrooms, Labs, a Conference Room, Science Learning Center, Digital Signage displays.
      b. An ~~Owner Furnished, Owner Installed (OFOI)~~ **ADD 3** integrated web enabled central control system will be used to control all aspects of the audio and video system's functions, signal routing, lighting, shades and audio levels. The control system shall be by Utelogy Corporation. Site licenses shall be procured by the College. The Contractor shall provide all programming and configuration and contract Utelogy for commissioning. **ADD 3**

B. Classroom, Lecture, Computer Lab – 900 SF to 1200 SF; Single Projector
   1. General
      a. The room shall be provided with a presentation system adequate for the display of high resolution computer graphics and pre-recorded audio-video media.

b. The system shall provide speech reinforcement (including ADA compliant assistive listening devices) features.
c. The projection system shall allow for interactive collaboration. Features include the ability to annotate images, save and share it.
d. An Owner Furnished, Contractor Installed (OFCI) lectern shall be provided to house an equipment rack with source and switching equipment.
e. A digital video presentation system switcher shall be used for control and matrix switching of audio and video signals.

2. Sound Reinforcement System
   a. Ceiling speakers shall be provided for sound reinforcement of voice and program material.
   b. Connectivity for a portable wireless microphone system shall be provided at the lectern. The system shall consist of a RF receiver and lavalier microphone to allow for voice reinforcement.
3. Video
   a. A wall mounted ultra-short throw video projector shall be provided to project general video media and computer presentation material onto a whiteboard. The projector shall be capable of at least 400 lux per square meter measured at the screen. The projector shall have a 16:10 aspect ratio capable of WXGA resolution. All relevant aspects of the video projector's operation shall be controlled via the main control system.
   b. A digital video presentation system switcher shall be used to route any source signal to the projector.
   c. An input panel shall be provided in the lectern to allow connection of laptop computer and portable audio-video equipment to the system.
   d. Sources installed in the lectern shall include the following OFCI equipment: document camera, Blu-ray player, PC and monitor,
4. Remote Control Systems
   a. An integrated web enabled central control system will be used to control all aspects of the audio and video system's functions, signal routing, and audio levels.
   b. A web based User Interface shall be provided to control and monitor all aspects of the AV system. The interface will be programmed to recall system presets.
5. Assistive Listening
   a. Connectivity for a portable Assistive Listening System (ALS) shall be provided per ADA requirements. The system will consist of an RF transmitter and headsets to allow personal monitoring of the audio program.

C. Large Classroom – 1575 SF to 1740 SF; Dual Projectors
1. General
   a. The room shall be provided with a presentation system adequate for the display of high resolution computer graphics and pre-recorded audio-video media.
   b. The system shall provide speech reinforcement (including ADA compliant assistive listening devices) features.
   c. The projection system shall allow for interactive collaboration. Features include the ability to annotate images, save and share it.
   d. An OFCI lectern shall be provided to house an equipment rack with source and switching equipment.
   e. A digital video presentation system switcher shall be used for control and matrix switching of audio and video signals.
2. Sound Reinforcement System
   a. Ceiling speakers shall be provided for sound reinforcement of voice and program material.
   b. A lectern mounted gooseneck microphone shall be provided for voice reinforcement of the instructor.
3. Video

a. Two wall mounted ultra-short throw video projector shall be provided to project general video media and computer presentation material onto a whiteboard. The projector shall be capable of at least 400 lux per square meter measured at the screen. The projector shall have a 16:10 aspect ratio capable of WXGA resolution. All relevant aspects of the video projector's operation shall be controlled via the main control system.
b. A digital video presentation system switcher shall be used to route any source signal to the projectors.
c. An input panel shall be provided in the lectern to allow connection of laptop computer and portable audio-video equipment to the system.
d. Sources installed in the lectern shall include the following OFCI equipment: document camera, Blu-ray player, PC and monitor,
e. In the Anatomy Lab (SC217), a ceiling recessed, PoE, PTZ camera shall be provided for directly above the demonstration table. The camera's signal shall be viewed via the Instructor's PC and routed to the projector as necessary. Camera control shall be per the web base interface as described below.

4. Remote Control Systems
   a. An integrated web enabled central control system will be used to control all aspects of the audio and video system's functions, signal routing, and audio levels.
   b. A web based User Interface shall be provided to control and monitor all aspects of the AV system. The interface will be programmed to recall system presets.
5. Assistive Listening
   a. Connectivity for a portable Assistive Listening System (ALS) shall be provided per ADA requirements. The system will consist of an RF transmitter and headsets to allow personal monitoring of the audio program.

D. Divisible Classroom – 1850 SF
1. General
   a. Each room shall be provided with a presentation system adequate for the display of high resolution computer graphics and pre-recorded audio-video media.
   b. The system shall provide speech reinforcement (including ADA compliant assistive listening devices) features.
   c. The projection system shall allow for interactive collaboration. Features include the ability to annotate images, save and share it.
   d. An OCFI~~Each~~ lectern shall be provided to house an equipment rack with source and switching equipment.
   e. Digital video presentation system switchers shall be used for control and matrix switching of audio and video signals.
2. Sound Reinforcement System
   a. Ceiling speakers shall be provided for sound reinforcement of voice and program material.
   b. A lectern mounted gooseneck microphone shall be provided for voice reinforcement of the instructor.
3. Video
   a. A wall mounted ultra-short throw video projector shall be provided in each room to project general video media and computer presentation material onto a whiteboard. The projector shall be capable of at least 400 lux per square meter measured at the screen. The projector shall have a 16:10 aspect ratio capable of WXGA resolution. All relevant aspects of the video projector's operation shall be controlled via the main control system.
   b. A digital video presentation system switcher shall be used to route any source signal to the projectors.
   c. An input panel shall be provided in the lectern to allow connection of laptop computer and portable audio-video equipment to the system.
   d. Sources installed in the lectern shall include the following OFCI equipment: document camera, Blu-ray player, PC and monitor,
4. Remote Control Systems
   a. An integrated web enabled central control system will be used to control all aspects of the audio and video system's functions, signal routing, and audio levels.

b. A web based User Interface shall be provided to control and monitor all aspects of the AV system. The interface will be programmed to recall system presets.

5. Assistive Listening
   a. Connectivity for a portable Assistive Listening System (ALS) shall be provided per ADA requirements. The system will consist of an RF transmitter and headsets to allow personal monitoring of the audio program.

E. Engineering Lab
   1. General
      a. The room shall be provided with a presentation system adequate for the display of high resolution computer graphics and pre-recorded audio-video media.
      b. The system shall provide speech reinforcement (including ADA compliant assistive listening devices) features.
      c. An OFCI lectern shall be provided to house an equipment rack with source and switching equipment.
      d. A digital video presentation system switcher shall be used for control and matrix switching of audio and video signals.
   2. Sound Reinforcement System
      a. Ceiling pendant speakers shall be provided for sound reinforcement of voice and program material.
      b. A lectern mounted gooseneck microphone shall be provided for voice reinforcement of the instructor.
   3. Video
      a. A ceiling mounted video projector shall be provided to project general video media and computer presentation material onto a motorized front projection screen. The projector shall be capable of at least 400 lux per square meter measured at the screen. The screen shall have a 16:10 aspect ratio capable of WUXGA resolution. All relevant aspects of the video projector's operation and the projection screen shall be controlled via the main control system.
      b. A digital video presentation system switcher shall be used to route any source signal to the projector.
      c. An input panel shall be provided in the lectern to allow connection of laptop computer and portable audio-video equipment to the system.
      d. Sources installed in the lectern shall include the following OFCI equipment: document camera, Blu-ray player, PC and monitor,
   4. Remote Control Systems
      a. An integrated web enabled central control system will be used to control all aspects of the audio and video system’s functions, signal routing, and audio levels.
      b. A web based User Interface shall be provided to control and monitor all aspects of the AV system. The interface will be programmed to recall system presets.
   5. Assistive Listening
      a. Connectivity for a portable Assistive Listening System (ALS) shall be provided per ADA requirements. The system will consist of an RF transmitter and headsets to allow personal monitoring of the audio program.

F. Conference Room
   1. General
      a. The system shall provide support for events such as meetings, teleconferencing and web conferencing.
      b. The system shall provide an ADA compliant assistive listening device features.
   2. Video

a. A wall mounted ultra-short throw video projector shall be provided in each room to project general video media and computer presentation material onto a whiteboard. The projector shall be capable of at least 400 lux per square meter measured at the screen. The projector shall have a 16:10 aspect ratio capable of WXGA resolution. All relevant aspects of the video projector's operation shall be controlled via the main control system.
b. An input panel shall be provided in the conference table to allow connection of laptop computer and portable audio-video equipment.
c. HDBaseT transmitters (with HDMI and VGA + audio connections) and receiver shall be provided to transport analog and digital signals from the conference table and credenza to the display.

3. Remote Control Systems
   a. The video display shall be controlled with a wall mounted controller as shown on the plan. The controller shall be capable of turning the display on and off, adjusting the volume, and switching sources.
   b. An integrated web enabled central control system will be used to control all aspects of the audio and video system's functions, signal routing, and audio levels.
4. Assistive Listening
   a. Connectivity for a portable Assistive Listening System (ALS) shall be provided per ADA requirements. The system will consist of an RF transmitter and headsets to allow personal monitoring of the audio program.

G. Science Learning Center
1. General
   a. The room shall be provided with a presentation system adequate for the display of high resolution computer graphics and pre-recorded audio-video media.
2. Sound Reinforcement System
   a. Ceiling speakers shall be provided for sound reinforcement of voice and program material.
   b. A lectern mounted gooseneck microphone shall be provided for voice reinforcement of the instructor
3. Video
   a. A ceiling mounted video projector shall be provided to project general video media and computer presentation material onto a motorized front projection screen. The projector shall be capable of at least 400 lux per square meter measured at the screen. The screen shall have a 16:10 aspect ratio capable of WUXGA resolution. All relevant aspects of the video projector's operation and the projection screen shall be controlled via the wall controller.
   b. An input panel shall be provided near the service desk to allow connection of laptop computer and portable audio-video equipment to the system.
4. Remote Control Systems
   a. An integrated web enabled central control system will be used to control all aspects of the audio and video system's functions, signal routing, and audio levels.
   b. A web based User Interface shall be provided to control and monitor all aspects of the AV system. The interface will be programmed to recall system presets.
5. Assistive Listening
   a. Connectivity for a portable Assistive Listening System (ALS) shall be provided per ADA requirements. The system will consist of an RF transmitter and headsets to allow personal monitoring of the audio program.

H. Public Area & Science Learning Center - Digital Signage Display
1. General
   a. These areas shall include a wall mounted 5048" or ~~6~~70" LED monitor used as digital signage displays.
   b. The video monitors shall have the ability to display information, including class schedule, current events, way finding and RSS feeds from the existing campus wide digital signage system.

c. The contractor shall supply and install an owner specified small form factor PC or signage server that is compatible with the existing digital signage system. The PC or server shall be connected to the College's LAN.
d. The displays and PCs shall include all mounting hardware required for proper installation.

I. Software Programming
1. General
a. Except when otherwise agreed in writing the client shall retain legal and beneficial ownership of all Intellectual Property, including source code, created by the Contractor, their employees and sub-contractors.
b. The Contractor must allow sufficient time for the programming of all software configurable audio, video and control systems. Contractors must evaluate the systems functional requirements and user interface and then allow time in their bid accordingly. The system description as well as the end user interview will provide the Contractor with the necessary information needed to proceed with the programming. Any questions as to the systems functional requirements must be sent in written RFI form to the Consultant. All programming schemes must be submitted to the Consultant for approval before programming starts. This includes the appearance of all user interfaces, touch panel layouts, preset and sub-preset information (acquired through client interviews), and speaker control schemes. The Contractor will also submit a narrative for the control system concept to the Consultant for approval. The Contractor is to interview the Owner and their representatives to acquire the necessary information needed to allow for the proper programming of this system. The Contractor, after interviewing the Owner, will then submit a written report stating his interpretation of the client's requirements for approval by Consultant. Only after the Client and Consultant have approved the programming report may the Contractor proceed with the programming of this system.
c. All equipment that is connected to the Client's local area network and is configurable via the local area network must have its equipment software installed onto dedicated computers provided by the Client. The Contractor is to allot time to install and test equipment software onto a minimum of two of the Client's computers which are to be identified by the Client and/or Consultant. The computers will be programmed to emulate user interfaces throughout the facility. The Contractor shall coordinate all software deployment over IP with the Client's Information technology department.
2. Control system minimum programming outlined below:
a. The Contractor shall allot 4 hours for on-site control system programming with the Client's representative.
b. The Control System in this project shall connect to the Client's Local Area Network (LAN). This connection will provide desktop computers control of the audio-visual system as well as make available remote troubleshooting via the internet. The Contractor shall provide time to install control system interface software on at least three desktop computers. Coordinate work with Client's Information Services personnel.
c. Provide password protection to each control surface in this facility. Upon start up a password dialog box shall be presented to the user to enter his/her password. Only after entering a password will the user have access to the system. The system shall be programmed to shut down automatically after being idle for a time to be specified by the user.
d. Unser Interface layout design will conform to the InfoComm International "Dashboard for Controls" guidelines. Touch panel designs are to be custom to this project. Re-purposed touch panel designs are not acceptable.
e. Technical users shall have the ability to access individual speaker zone controls via the User Interface.
f. The contractor shall provide a default audio level preset button, in the control system user interface, to allow a user or technician to recall all gain levels that were set when the system was commissioned.
g. Control Help File: Each touch panel will include a help file that will explain each layer of the touch-panel control scheme.

h. Control system shall utilize help desk software to provide:
    1) Real-time monitoring of:
        (a) Control system.
        (b) Device monitoring.
        (c) Projector lamp life.
        (d) System online status.
        (e) Room activity.
    2) Remote system diagnostics via Contractors help desk.
    3) Remote system control.
    4) Event scheduling.
    5) Fault reporting via email alert.
    6) Logging of help request.
    7) User access control via password protection.
    8) Event logging, report and chart generation.
i. The help desk software shall be placed on the desktop computers of each audio-visual maintenance person as well as key personnel of the Client. The Contractor shall train maintenance and operations persons to use this software feature.
j. Provide, install and test, room scheduling software programs to allow scheduling of each AV enabled room.
k. All serial controlled devices must have bi-directional communication with the control system. All control functions locally available on each device must be accessible via the remote control system. All locally gestured control functions must mirror on the control system user interface. In other words, if a volume control is adjusted on a DSP interface that adjustment must register on the control interface.
l. Control system shall be used to power up and down connected equipment at control system start up and shut down.
m. Control system shall control both lighting and motorized window shades in each room. Provide adequate presets to allow training and video conferences as explained in room descriptions above.
n. The control system shall monitor the connected power amplifiers and report overheating that may occur.
o. All projectors shall be monitored and report lamp hours remaining and lamp failure.

3. Complexity of Programming:
    a. It is required that the Contractor be experienced in programming systems of this complexity. Contractors shall allow enough time in their bid to permit extensive programming of all software configurable audio, video and control systems to the requirements of the client and consultant. Contractor shall break out cost associated with programming of these systems for review by the Consultant. By submitting this bid, the Contractor agrees that they understand systems of this type and that all programming services are included to the satisfaction of the Consultant. The Contractor further agrees that they will not make any claim for additional monies because of misinterpretation of programming requirements.

J. System Performance Standards and Requirements (meet or exceed)
1. Audio Systems:
    a. Electrical Performance; Source Input to Power Amplifier Output:
        1) Frequency Response (Equalizer flat): +/- 0.2 dB 20 Hz to 20 kHz.
        2) Total Harmonic Distortion (THD): Less than 0.05%, 20 Hz to 20 kHz, 4 ohms.
        3) Noise: At least -105 dB, 20 Hz to 20 kHz, referenced to input of +4 dBm.
        4) Crosstalk: At least -60 dB, 20 Hz to 20 kHz.
        5) Damping Factor: Greater than 500 (below 1 kHz)
    b. Electro/Acoustic Performance; Distributed Systems: 103 dB Consistent with devices specified herein.
        1) Equipment: Specified individually.
        2) Audio signal paths: Shall not degrade performance of connected equipment.

c. NEC - Article 640: Audio Signal Processing, Amplification and Reproduction Equipment.

2. Video Systems:
   a. Video signal system: NTSC to EIA RS-170A, except as noted.
   b. Video signal paths: To EIA RS-250C short haul where equalized or fiber optic transmission, otherwise to the performance limit of the specified video cable.
   c. ANSI IT7.228 (ANSI Lumens): Measurement method for light output of fixed resolution video projection systems.
   d. ANSI IT7.228 (ANSI Contrast Ratio): Measurement method for the contrast ratio of fixed resolution video projection systems.
   e. SMPTE 170M: Color Specification for NTSC.
   f. SMPTE 125M: Universal Sampling spec for SDTV and HDTV Broadcast Video.
   g. SMPTE 253M: RGB Analog Video Interface spec for SDTV Studio applications.
   h. SMPTE 274M: Component spec for 1920 x 1080 HDTV.
   i. SMPTE 296M: Spec for 1280 x 720 RGB and YPbPr Baseband Video.
   j.
3. Data and Communications Systems:
   a. TIA/EIA 568-C series: Commercial Building Telecommunications Cabling Standard.
   b. ANSI J-STD-607-A: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
   c. Comply with ITU-T (International Telecommunications Union – Telecom) for video conferencing systems.
4. Control Systems:
   a. RS485 (TIA-485): Electrical characteristics of generators and receivers for use in balanced digital multipoint systems.
   b. RS232 (TIA-232): Interface between data terminal equipment and data circuit-terminating equipment employing serial binary data interchange.
   c. RS 422 (TIA-422): Electrical characteristics of balanced voltage digital interface circuits.

K. Portable assistive listening system shall be utilized in lieu of built in assistive listening systems to comply with ADA requirements. The system shall consist of an RF transmitter and headsets to allow personal monitoring of the audio program for the hard of hearing. The AV Contractor shall provide a portable system for 30% of audio enabled rooms as a minimum. The contractor shall round up to the next highest number of systems for this calculation when fractional numbers result. Each system shall be supplied with 2 receivers, headsets and neck loops. Assistive listening signage shall be provided at each AV enable room to identify the availability of auditory assistance equipment. ***ADD 3***

1.5 SUBMITTALS

A. General
1. In addition to the requirements of Division 1, submit all materials for review arranged in the same order as the Specification, individually referenced to the Specification paragraph and Contract Drawing number. Submit 8 1/2" x 11" items bound in volumes and drawings in edge-bound sets. Submit all drawings on sheets of the same size.
2. The Contractor is to provide two copies of each hardcopy submittal and an electronic format copy (Shop drawings must be submitted as DWF. All other submittals will be provided as .PDF). All submittals must be original files or documents scanned copies will not be accepted.
3. Make each specified submittal as a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.
4. Should the Contractor proceed with the Work of this Section in the absence of submittals for such work submitted and returned with action "No Exception Taken" or "Make Corrections As Noted", the Contractor proceeds at the Contractor's sole risk.

5. In the event that the Contractor deviates from the design shown on the audio-visual Contract Documents when preparing their shop drawings, the Contractor shall indicate with architectural style clouding, those deviations. The Contractor shall also submit with the Shop Drawings, a list of those deviations and substitutions, including the following:
    a. The deviation item number which shall also correspond to a number designation applied to each cloud on the shop drawings.
    b. Section of the specification that applies to these changes.
    c. The applicable shop drawing sheet number for each item.
    d. The corresponding audio-visual Contract Document sheet number for each item.
    e. A clear description of the deviation.
    f. The Contractor's rational for the deviation (i.e. what benefit the deviation provides, why it is required, any cost impact, etc.).

B. Infrastructure
    1. Provide drawings indicating boxes conforming and non-conforming to Consultant's AV drawings.

C. Product Data
    1. Manufacturer's Product Data
        a. Contractor is to submit submittal in electronic format (i.e. PDF)
        b. List of materials (i.e. Table of Contents) categorized by room type: For each item specified in PART 2, include:
            1) Drawing device ID code.
            2) Manufacturer.
            3) Model number.
            4) Listing: UL or other lab.
            5) Quantity.
        c. In sequence of List of Materials, provide a data sheet for each item, including all accessories marked for the proposed product.

D. Shop Drawings
    1. Field (Installation) Drawings: Collate in sequence:
        a. Contractor is to submit shop drawings in .DWF format.
        b. Drawing index/symbol sheet.
        c. Floor plans. At scale of Contract Documents. Show:
            1) Device rough-in boxes with ID number.
            2) Mounting height.
            3) Conduit size.
            4) Wire type.
            5) Wire fill.
        d. Sections/Elevations. At scale of Contract Documents:
            1) Mounting location reference to nearest gridline.
                (a) Provide sections for each room containing AV equipment.
                (b) Provide elevations for each wall in rooms containing AV equipment.
                (c) Show all equipment, including speakers, monitors, projectors, podium, floor boxes, facility boxes, etc.
                (d) Provide vertical dimensions referenced above finished floor to each piece of equipment.
                (e) Provide horizontal dimensions reference to gridlines.
        e. Enlarged Plans. At scale of Contract Documents or larger as required for trade coordination. Show:
            1) Items indicated in "floor plans" above.
            2) Architectural features.
            3) Rack cabinets.
                (a) Ventilation details.
                (b) Power distribution detail.

4) System furniture.
5) Clearances required by applicable Code.

f. System Conduit Riser Drawing, Show:
1) Terminal cabinets.
2) Coordination with floor plans.
3) Wire runs not shown on floor plans.
4) Wire type.
5) Wire fill.

g. Mounting details:
1) Stamped and signed by an Engineer licensed in the Project jurisdiction for work of this type, where required by code.
2) Show loads, type and strength of connections, sizes, dimensions, materials, etc.
3) Show calculations on drawings or in bound volume for review by Authorities having jurisdiction.
4) Provide details for:
(a) Equipment rack anchorage.
(b) TV Monitor mounts.
(c) Loudspeaker mounts.
(d) Video projector mounts.
(e) Video displays.
(f) Projection screens, both fixed and motorized.
(g) Attachment to building structure.

h. Installation details as required:
1) Terminal cabinets: Terminations.
2) Audio-Visual panel details.

i. Wire run sheets. Show:
1) Wire number.
2) Source.
3) Designation.
4) Signal type.
5) Wire type.
6) Operating level or voltage.
7) Timing reference, where applicable.
8) Physical length.

2. Shop (Fabrication) Drawings: Collate in sequence:
a. Contractor is to submit shop drawings in .DWF format.
b. Drawing index/symbol sheet (if separate set from Field Drawings).
c. System functional drawings. Submit separate drawings for each system/subsystem. Show at least:
1) Equipment:
(a) Function, make, model.
(b) Rack number, module frame and slot number.
2) Field device information
(a) Terminal cabinets.
(b) Pull boxes.
(c) Audio-visual panel connector designations.
3) Wiring
(a) Wire number.
(b) Wire type.
4) Shield condition at both ends (float, ground, location of ground).
5) Connector wiring details, each type.
6) Audio: Nominal operating level, Polarity. Note deliberate polarity inversions where required to maintain absolute polarity.
7) Video: Physical length. Electrical length in nanoseconds or degrees of sub-carrier, as applies. Equalization required.

8) Twisted pair, transmit and received devices: Transmission range at 60 Hz., cable length and signal quality.

d. Provide drawings for the following systems, if applicable:
   1) Audio.
   2) Video.
   3) Control.
   4) Data transmission.
   5) Coordinated grounding scheme.

e. Equipment rack elevations: Show:
   1) All racks scaled at 1 1/2" equals 1 foot, or larger.
   2) Rack: Make, model.
   3) Equipment: Function, make, model.

f. Rack wiring drawings: For each rack, show:
   1) Power strip: Receptacles, circuiting.
   2) Sequencing power and surge suppression systems.
   3) Equipment.
   4) Grounding.
   5) Wiring, all systems.
   6) Wiring harness scheme.
   7) Ventilation detail.

g. Fabrication details: Submit for:
   1) Receptacles.
   2) Panels.
   3) Special mounting provisions.

h. Legends/engraving details. Half or full size:
   1) Receptacles.
   2) Audio-visual panels.
   3) Equipment designations.
   4) .

E. Samples
1. Of all finishes/materials that will be visible to the public, including but not limited to:
   a. Receptacles and controls with associated trim plate.
   b. Each type of loudspeaker baffle and/or grille.
   c. All audio-visual panels.
   d. Audio-visual devices in public areas.

F. Programming
1. Control Programming Scheme Submittal
   a. Contractor is to submit submittal in electronic format (i.e. PDF)
   b. Provide a password-protected link to a folder on the Contractor's network to remotely access the touch panel from the Consultant's computer. Contractor is to have a dedicated control processor utilized on their network.
   c. Provide a graphic layout of each user control interface (touch panels, push buttons, etc.).
   d. Provide a list of devices that are controlled by each control user interface, including:
      1) Device.
      2) Brand.
      3) Model Number.
      4) Control Method.
   e. Provide a logic tree for each page for each control interface.
   f. Provide a system routing sheet for each control user interface, including:
      1) Source.
      2) Switcher / device input.
      3) Switcher / device output.
      4) Final destination.
   g. Provide help file content on each user interface.

G. Shop and Project Site Test Reports
   1. Contractor is to submit submittal in electronic format (i.e. PDF)
   2. Schedule: Submit test reports in a timely manner relative to the Project schedule such that the representative of the Owner may conduct Verification of Submitted Test Data without delay of progress.
      a. Shop test report: Submit prior to shipping completed equipment racks to Project Site.
      b. Project Site test report: Submit project site test report for this section after system completion and prior to Acceptance Review and Testing.
   3. Content: Include at least:
      a. Time and date of start of burn-in.
      b. Time and date of test.
      c. Personnel conducting test.
      d. Test equipment, including serial and date of calibration.
      e. Procedures used.
      f. Results of test - numerical or graphical presentation.

H. Close Out Submittal
   1. Contractor is to submit submittals in electronic format (i.e. PDF)
   2. Operation and Maintenance Manuals
      a. Index.
      b. Systems operating instructions.
      c. Reduced set of system Record Drawings.
      d. Key schedule.
      e. Maintenance and spare parts schedules.
      f. Shop and Field Test Reports.
      g. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals in color for each equipment item. Provide tabbed dividers between each product. Manuals provided by the Manufacturer in an individual binder may be submitted in that form.
   3. Framed Operating and Maintenance Instructions: Provide adjacent to each ensemble of equipment racks. Provide sturdy frame with clear glass or non-scratching plastic cover. Provide permanent, non-fading media. Blueprints shall not be acceptable. Include:
      a. Sequence for system start-up and shutdown.
      b. System Functional Diagrams.
      c. Signal levels and impedance at accessible system signal and test ports, where applicable.
   4. Record Drawings
      a. As work progresses, maintain records of "as installed" conditions. Update the set at least weekly. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to final Record Document drawings, as specified in Division 1.
      b. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.
   5. Provide four copies on CD-ROM containing the “as built” drawings, all manuals, training manual and programming code.
      a. Submit un-compiled programming code.
   6. Training Submittal
      a. Provide all training materials for review prior to scheduling training sessions.
         1) Training manual.
         2) Agenda for the training session.
         3) The final punch list, indicating that all equipment is fully functional.
      b. See the section under Owner’s Instructions for training manual requirements.
      c. No training session will be scheduled until final punch list is completed and submitted.
   7. Warranty Certificates
      a. Comply with Division 1.

1.6 QUALITY ASSURANCE

A. Qualifications

1. The bidder shall, prior to the bid, in accordance with the Instruction to Bidders, submit at least the following information to verify that the bidder has the necessary experience and qualifications to perform the specified work:
   a. A detailed brochure describing the bidder's capabilities in terms of facilities, personnel (include a personnel organization chart followed by resumes), experience, background, examples of similar installations (at least two projects within the past two years), distribution arrangements with manufacturers and financial capability, including certificates of insurance and satisfaction of the project bonding requirements.
   b. Contractor must, at the time of this bid submittal, have distribution or a dealership agreement with all manufactures whose products are specified in the bid documents. Contractor must also have completed manufactures training and certification before bids are submitted.
   c. Information identifying any and all local agents and/or subcontractors that will assist in the work and their role in the project.
   d. Identification of sources of labor for all fabrication and installation throughout the duration of the project.
   e. Evidence that he has acquired all necessary licenses, certificates and approvals to perform the specified work within the state or jurisdiction the work is to be performed.
2. Projects that include networked audio or video systems will require the Contractor to submit the name of the person, in their employment, qualified to perform this work. This person shall have certification in computer network technology and hold one of the following certifications:
   a. CNP – Certified Network Professional Program.
   b. Computing Technology Industry Association - Network+ certification.
   c. MCSE – Microsoft Certified Systems Engineer.
   d. CNE – Certified Systems Engineer.
   e. CCNA – Cisco Certified Network Associate.
3. Projects that include software configurable, integrated central control systems must include, as a sub-contractor, an authorized independent programmer who is fully engaged in the work of programming. The Contractor is to enter into an agreement utilizing the authorized independent programmer as a sub-contractor. Under this agreement, the Contractor will retain all of the responsibility for a complete and working system. The Contractor must include in their bid time to work out any programming glitches that may occur in the initial programming stage. These items include working through the initial and final programming stage with the authorized independent programmer to provide a functional system, testing the programmer's graphical user interface for intended functionality and provide onsite support for the programmer in the uploading and testing of programming revisions. The control systems programmer shall be present either by web meeting or in person at the end user interviews to acquire information first hand. The control systems programmer shall submit a report outlining the meeting results to Contractor for approval. Only when the Contractor approves this report shall it be submitted to the consultant for review. If the contractor does not employ a fulltime programmer, the following companies have been approved subject to above.
4. The Contractor will provide information on how and by whom the requirements of the warranty period will be fulfilled.
5. The submittal must justify, in the judgment of the Consultant, the Architect, and the Owner, that the Contractor has the capability to manage and install a project of this size and scope and that he is capable of the necessary business and technical arrangements for this installation and the pursuant warranty service. Contractor may be disqualified as a bidder if all of the submittal does not meet the approval of the Owner and his/her representative.

6. Company: Work of this Section shall be performed by a Sound or Audio-Visual Systems Contractor who has at least five years direct experience with the devices, equipment and systems of the type and scope specified herein, and who has a fully staffed and equipped maintenance and repair facility, and who is licensed to perform work of this type in the Project jurisdiction. The company must be NSCA R-ESI or CTS certified.
7. Personnel: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section. Supervisors shall have at least five years direct experience in similar work. Installation and maintenance personnel shall have at least three years direct experience in similar work. Contractors shall have at least 60% of their installation staff CTS or C-EST certified.
8. Designated Supervisor: Provide a designated supervisor present and in responsible charge in the fabrication shop and on the Project Site during all phases of installation and testing of the Work of this Section. This supervisor shall be the same individual throughout the execution of the Work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.
9. Staff Engineer: The Contractor shall have on his full-time payroll at least one staff engineer having five years minimum experience as an electronics engineer covering systems and projects comparable in substance and complexity to the project described herein. The staff engineer shall have NICET certification in Electrical/Electronics Engineering Technology and Audio Systems or equivalent. The signature of that engineer shall appear on all shop drawings and submittals.
10. Coordination: Coordinate the Work of this Section with the Work of all other Separate Contracts. Comply with Division 1.
11. Help Desk: The Contractor must employ a fully staffed help desk department that shall provide knowledgeable responses to inquiries regarding system operation. This department must also have the ability to provide remote diagnostics to identify equipment faults for troubleshooting.

B. Cutting and Patching
1. Cut, patch and extend existing work using skilled mechanics that are capable of matching existing quality of workmanship.
2. Assign work of moving, removal, cutting and patching, to trades qualified to perform the work in a manner to cause least damage to each type of work, and provide means of returning surfaces to appearance of new work.
3. Perform cutting and removal work to remove minimum necessary, and in a manner to avoid damage to adjacent work. Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in a straight line at a natural point of division.
4. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible.
5. Protect existing finishes, equipment, and adjacent work that are scheduled to remain, from damage.
6. Promptly repair damages caused to adjacent facilities by demolition operations, at no change in Contract Amount.

C. Painting
1. Use skilled mechanics that are capable of painting audio-visual equipment and hardware to match architectural surroundings, where applicable.

D. Regulatory Requirements
1. Regulations Applicable: including but not limited to those defined in Division 1.
2. Comply with all applicable federal, state, and local labor regulations, and applicable local union and trade regulations.

3. Installation practices shall be in accordance to industry-accepted standards (ANSI, Cal-OSHA, IEC, IEEE, FCC, NEC, NFPA, ICIA, NSCA, CEDIA, BICSI) or local acts, codes and standards enforced at the place of work, whichever is most stringent.
4. Procure and pay for all necessary permits, licenses, inspections, and observe any requirements stipulated therein.
5. Provide UL/ULC fire rated enclosures around all audio-visual floor and back boxes where required by code.

E. Programming
1. User Group Interview:
a. Conduct interviews with the end-users to acquire programming requirements. Submit written results of the interview and the requirements set forth by the user group. Associate the user group requirements into the programming of each sub system. Submit to the Consultant a report that outlines the interviews conducted.

F. Pre-installation Meetings
1. Attend a pre-installation meeting at the project site with the Owner and his representatives in order to coordinate related work and scheduling issues.

G. Verification
1. Verify dimensions and conditions at the Project Site. Submit any conflicts in timely manner for resolution.

H. Shop Fabrication and Testing
1. Assemble and fully wire equipment racks at a fabrication shop off the Project Site. Burn-in for not less than 120 hours. Following burn-in, perform specified adjustment procedures. Provide test equipment and test according to procedures specified herein. Submit verification of shop test in timely manner. Following verification of shop test and when installation locations are ready as specified herein, deliver equipment racks and equipment to the Project Site and install.

I. Project Site Installation and Testing
1. Install as specified herein.
a. Perform specified adjustment procedures. Provide test equipment and test according to procedures specified herein. Request verification of Project Site test in timely manner.

J. Verification of Submitted Test Data
1. Re-test in presence of designated representative(s) of the Owner at reasonable mutual convenience. Provide services of the designated supervisor and an additional technician familiar with work of this Section. Provide all test equipment. Provide complete set of latest stamped submittals of record for reference. Provide complete set of Shop and Project Site Test Reports, as applies. Provide a complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

K. Reference/Project Record Documents
1. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete set of the latest stamped, action submittals of record for reference. Also maintain a separate, clean, undamaged set for preparation of Project Record Documents. Also maintain at the workplace a complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading

1. The Contractor will take receipt of all Owner Furnished Equipment at the project site or at a local warehouse.
2. Deliver materials in manufacturer's original undamaged packages or in bulk packing which provides equivalent protection from rough handling, dust and dirt.
3. Deliver all assembled equipment racks in custom manufactured wood crates to avoid damage during shipping. Contractor is to hire a crate manufacturer to build crates prior to delivering racks to the jobsite.
4. All packing, shipping, insurance, handling and storage costs of equipment and materials shall be the responsibility of the Contractor.
5. The Contractor shall be responsible for insuring all equipment and installation materials stored in their shop facilities until it is delivered to the Project Site and a delivery acknowledgement is received from the Owner or its authorized representative.
6. Equipment unpacked for inspection but not ready for permanent installation must be returned into its protective packing.
7. The Contractor shall be responsible for furnishing a temporary substitute for equipment that could not be delivered in time for system operation. All costs associated for renting, shipping and handling temporary substitute equipment shall be the responsibility of the Contractor.
8. In the event the equipment or installation material delivery is delayed, the Contractor must employ the fastest means of delivery service available to deliver the equipment on time. All costs for expediting the delivery of equipment shall be the responsibility of the Contractor.
9. Store packaged materials off of the ground or slab in a manner to protect them from elements, especially moisture damage.
10. Deliver completed, wired, tested equipment racks to associated equipment rooms at the Project Site when major work of all other separate contracts is complete, equipment room ventilation is operating with clean filters in place, the area is clean and free from airborne contaminates, and continuing work of other trades will not produce airborne contaminates or permit transport of such airborne contaminates to the equipment rooms.

B. Acceptance at Site
1. All equipment and installation material delivered to the Owner shall be properly documented in the form of delivery receipts.
2. Equipment delivered to the Project Site must have a delivery acknowledgement receipt signed by the Owner or its representative. Issue a signed copy of the delivery receipt to the Owner and file the signed copy for future reference.
3. The Contractor shall be responsible for the insurance coverage and security of equipment delivered to the Project Site until it receives an acknowledgement of delivery from the Owner or its authorized representative.

C. Storage and Protection
1. The Contractor shall provide a safe and secure storage location for all equipment and installation materials until they are delivered to the Project Site and it receives an acknowledgement of delivery from the Owner or its authorized representative.
2. For equipment assembled and tested at the Contractor’s shop facility and delivered to the Project Site, ensure that the equipment is properly protected from improper handling, rain, water, humidity, moisture, heat, direct exposure to sunlight, dust and dirt during delivery and storage on or off the Project Site.
3. Do not remove protective packing from equipment until they are ready to be installed.
4. If, after equipment is installed, the Project Site cannot be cleaned or is still not clean because of on-going work by others, provide protective covering and protection to prevent airborne dust and dirt originating from damaging equipment.

1.8 PROJECT SITE CONDITIONS

A. Environment Requirements
1. The spaces where audio-visual system assemblies are installed shall meet the following requirements:
   a. Free from dust generated from construction.

b. The room temperature shall be within the specified operating temperature recommended by the manufacturer.

1.9 SEQUENCING

A. Submit all testing documentation to the Owner's Representative for review prior to requesting the Fabrication Inspection and Substantial Completion inspections.

B. Allow adequate time for corrections to be made after inspections to maintain the Project Schedule.

1.10 SCHEDULING

A. Comply with the Project schedule.

B. Make all Submittals specified herein in a timely manner. Failure to make timely submittals complete as specified herein is considered to be lack of substantial progress of the Work of this Section. Contractor is to work around client schedule throughout the duration of the project.

C. Deliver all equipment, devices and materials required for the Work of this Section and install, test and ready all work for Acceptance Testing at least fourteen days prior to the completion date for the associated area of the Project, unless specifically instructed otherwise by the Owner.

D. Temporary Equipment: Provide and operate, without claim for additional cost or time, temporary equipment and/or systems to provide reasonably equivalent function, as determined by the Owner, in lieu of the Work of this Section which is incomplete or found not in conformance with the Contract Documents as of seven days prior to the completion date. Provide such temporary equipment until Acceptance of the Work of this Section. Thereafter, remove such temporary equipment.

E. It shall be a common understanding that there is a time constraint when executing this work. The Contractor shall use all means and resources to complete this project on or before the specified schedule at no additional cost to the Owner. This includes working beyond normal business hours and days, additional manpower, additional tools, etc.

1.11 WARRANTY SERVICE

A. Warrant all Work of this Section to be free from defects in materials and workmanship for a minimum of 2 years from the date of Owner acceptance of the Work of this Section.

B. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of system acceptance. In the case of Contractor modified equipment, the manufacturer's warranty may be voided. In such cases, provide a warranty equivalent to that of the original manufacturer.

C. All high-level software shall follow the warranty conditions specified by the manufacturer. Immediately update or upgrade the Owner's installed software as soon as new versions, updates or patches become available from the manufacturer at no additional cost to the Owner within this warranty period.

D. Response Time: Provide a qualified technician familiar with the work at the Project Site within 12 hours after receipt of a notice of malfunction. Provide the Owner with the telephone number attended 8 hours a day, 5 days a week, and an answering service or equivalent facility attended 24 hours a day, 7 days a week, to be called in the event of a malfunction. Provide repairs at no expense to the Owner and at the Owner's request, alternate facilities, services and systems for the duration of the repairs to any defective work of this Section. Provide a complete and operational System, within 48 hours after notification of a malfunction.

E. All work requested due to warranty issues shall be performed during regular working hours unless the Owner agrees to pay the difference in labor rates for overtime or night time work.

F. The Contractor shall use qualified service personnel to respond to all warranty issues or calls.

G. Off Site Service: Conduct all warranty repairs and services at the Project Site, unless in violation of manufacturer's standard product warranty. Provide substitute systems, equipment, and/or devices acceptable to the Owner for the duration of off-site repairs. Provide transportation for substitute and/or test systems, equipment, devices, materials, parts and personnel to and from the Project Site.

1.12 OWNER'S INSTRUCTIONS

A. General
   1. Conduct training on the completed system at a reasonable convenience of the Owner during normal Owner business hours. Contractor is to assess the complexity of the system and shall fully train the operation and maintenance staff named by the Owner.
   2. Do not start training until all systems have been commissioned, training manuals are approved and an agenda along with schedule of each departmental training session has been submitted to the owner.
   3. Training will be conducted in the actual room that is the topic of the training session.
   4. The client asserts legal and beneficial ownership of all training materials which are specifically commissioned for this project.

B. Operator Training – Do not start training before system is in full operation and all components have been signed off by owner's representative. Use the items covered in the commissioning portion of this specification as a basis for the training curriculum.
   1. At least two 4-hour sessions of instruction will be given in order to familiarize the Owner with the operation of the system.

C. Maintenance Training
   1. At least ~~two~~ three 2~~3~~ - **ADD 2** hour sessions of instruction will be given in order to learn how to maintain and troubleshoot the system. A maintenance binder shall be provided by the Contractor with all manufacturer-specific operating and maintenance information for each piece of equipment used. On large jobs, the binders will be sub-divided into individual audio, video and control binders. Provide training on at least the following system features:
      a. Firmware upgrades
      b. Helpdesk features
      c. Complete use of system as outlined in the Commissioning section plus advanced troubleshooting.

D. Training Video
   1. A training video shall be produced and cover all aspects of the systems operation.
   2. Each page of all user interfaces shall be explained and recorded while gestures are made on the screen. Each button on the user interface shall be explained and demonstrated.
   3. All portable equipment that connects to the system shall be demonstrated both in their physical connection and routing method at the user interface.
   4. All patch bays shall be explained and demonstrated.
   5. All source equipment shall be explained in both physical loading of media and transport control as well as user interface control.
   6. Demonstrate on basic troubleshooting.
   7. Provide training on items as outlined in the Commissioning section of this document.
   8. Demonstrate system start up and shut down.
   9. Explain and demonstrate help files associated with touch panels.
   10. Audio and video files shall be combined and burned to DVD for distribution to each department.
   11. Provide professional DVD with searchable index of topics covered.
   12. Provide label with client's logo, room name/number, title, length and topics covered.

E. A training manual specific to this system will be written covering the basic and advanced functional techniques necessary to operate the system in a reliable and fully-functional condition. The Contractor shall submit hard color copies of the training manual as well as a soft copy in PDF or DOC format. Provide a hard copy of the training manual for each person to be trained. This manual will include:
   1. All contact information, including emergency and after hours phone and pager numbers, for requesting service assistance from the Contractor.
   2. A 11x17 set of as-built drawings of the completed project (a full-sized set will be issued to the client for their use, a half-size set will be attached to the inside back door of the main equipment rack).
   3. A table of contents at the beginning of the manual.
      a. The manual will begin by explaining basic information such as manual references, abbreviations, any assumptions made by the author, prerequisites required, numbering convection, etc.
      b. It will then proceed to the manual objectives.
      c. Explain what the end user should understand after reading the manual.
      d. It will cover the basics of the user interface including start up and shut down procedures, log on procedures, access privileges, operator password, levels of security, file structure, etc.
      e. The manual will proceed to describe each user interface and its function. It will cover every layer of the interface and how to navigate through them.
      f. Each of the system presets will be explained and the physical setup of the equipment and floor plan during presets will be illustrated. Source equipment such as CD players, Cassette, VCR, etc. shall have their routing scheme explained and illustrated. Portable equipment and its connection to the system shall be explained and illustrated.
      g. The manual will end by explaining basic troubleshooting procedures and equipment care instruction.
   4. The Contractor's maintenance instructions, which will include the manufacturer's maintenance instructions found on the factory manuals to keep the manufacturer's warranty in force.
   5. A list of consumables (lamps, fuses, batteries, etc.) required to keep the system operating over time, along with sources of supply (if not readily available).
   6. The Contractor will compile and submit all factory warranty registration forms or cards for each piece of equipment furnished for this project.
   7. A form requesting feedback from the end user as to how the manual should be improved and a section to report errors discovered.
      a. The Contractor will make the corrections and improvement suggestions after receiving feedback from the users. This will be completed at no charge to the client. The manual will contain a date stamp and version number. Each feedback and error correction manual reissue will include a new version number.

F. Initial Use Support
   1. Provide standby trainer/system engineer during the first two public events.

1.13 ~~MAINTENANCE~~WARRANTY *ADD 3*

A. The Contractor shall, within the warranty period, schedule two visits to inspect and perform preventive maintenance on the system. The first visit shall be six months after the commencement of the warranty period. The last visit shall be just prior to the end of the warranty period.

B. Return 90 to 120 days after the system has been turned over to the Owner for additional programming, maintenance and system fine-tuning. Conduct interviews with the user group via telephone to acquire information needed to complete this task. Allow for one full day of programming in your initial bid to complete. Provide a per hour programming fee that will be charged if additional programming is needed.

C. Cache for event logging must be set to record unlimited events until the Contractor's first maintenance site visit. After the Contractor's first maintenance site visit, the cache can be limited to the Owner specified level.

D. The Contractor shall use qualified service personnel to conduct all maintenance work.

E. All maintenance work shall be performed during regular working hours unless the Owner agrees to pay the difference in labor rates for overtime or night time work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Quality of Products
   1. Materials and equipment specified herein have been selected as the basis of acceptable quality and performance and have been coordinated to function as components of the specified systems.
   2. Where a particular material, device, piece of equipment or system is specified directly, the current manufacturer's specification for the same shall be considered to be a part of these specifications, as if completely contained herein in every detail.
   3. Each material, device or piece of equipment provided herein shall comply with all of the manufacturer's published specifications for that item.
   4. Equipment shall be from the manufacturers' current stock and shall not be stored longer than 1 year prior to installation, unless written approval to do otherwise is provided by the manufacturer and submitted for review by the Owner.
   5. All products will be a product of firms regularly engaged in the manufacturing of electrical, electronic or optical equipment. The equipment will be the latest model or type offered which meets the applicable specifications at the time of the submittal. Discontinued items replaced by newer models or versions are prohibited and should not be submitted for review.
   6. Quality of workmanship and fabrication of all equipment and components, which are custom fabricated, shall be comparable to professional equipment produced by specialized manufacturers of the trade involved and will be verified by inspection. Only firms having 5 years of experience in all aspects of the fabrication and installation of similar systems will be allowed to perform the work.
   7. All materials and products will be new and of professional quality. Unless specifically stated in the drawings or specifications, no existing or used materials will be installed.

B. Quantity
   1. Provide the quantity of products as shown on the Contract Drawings, or as otherwise indicated herein.
   2. The equipment listed in section 2.2 consists of all major equipment for the project. The Contractor will integrate into the system design and provide any additional components, wiring, programming, etc., to complete a functional system operating as described within the specifications and the category AV drawings.
   3. Components or equipment not specified or indicated on the drawings that are required to make a fully functional systems per the Owner's requirements and the design intent, shall be furnished and installed by the Contractor, and shall be submitted for Owner review.

C. Preference
   1. Where more than one manufacturer is listed herein as acceptable or equivalent, no preference is intended or implied by the order of listing.

D. In the event that a specified piece of equipment or product has been superceded, discontinued or is no longer available from the manufacturer, the Contractor shall submit a request for substitution of the originally specified product. The substitute product shall be the manufacturer's most current model of the specified product, or if the line has been discontinued, a product by the same manufacturer with specifications meeting or exceeding, and as close as possible to those of the originally specified product. Refer to Alternatives and Substitutes section for clarification.

E. Deferred purchase of equipment, including computers, touch panels, flat panel displays and video projectors with short market life expectancy
   1. Applies to the installation of equipment that is scheduled to take place more than 8 months after the bid has been awarded.
   2. Contractor shall, with his bid, breakout pricing for the above mentioned equipment and provide an allowance for these items.

3. Ninety Days prior to its purchase, the Contractor shall submit for the Consultant's approval, a list of the equipment that has replaced or superseded the specified equipment.
4. The submittal will include the manufacturer's specification sheets and other documentation to verify that the equipment meets the standards of the original specification.
5. In the event that the Contractor's allowance for the equipment to be installed exceeds the current pricing, the price differential shall be returned to the Owner as a credit. The credit shall include the current price differential plus markups for overhead and profit and shall be documented in writing.
6. In the event that the current pricing exceeds the allowance, the Contractor shall submit a detailed cost breakdown clearly indicating the current pricing differential and all markups requested.

F. Provide Complete
1. Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section as if specified in full herein.

G. Provide New
1. All materials provided under the Work of this Section shall be new, shall be the manufacturer's latest design/model, and shall be permanently labeled with the manufacturer's name, model number and serial number.
2. Products and materials shall be clean, free of defects, damage and corrosion.

H. Similar
1. Similar devices shall be of the same manufacturer, unless specifically noted otherwise in these specifications.

I. Safety Agency Listing
1. All devices provided under the Work of this Section that are connected to the Project electrical system shall be listed by Underwriters Laboratories (UL) or other Nationally Recognized Electrical Testing Laboratory acceptable to the Authorities having jurisdiction at the Project site, and shall be so labeled. Absent such listing, comply with Regulatory Requirements applicable to Unlisted Equipment.

J. Unlisted Equipment
1. Certain equipment specified herein may not bear listing by a Nationally Recognized Testing Laboratory. Such equipment is specified herein only where no equipment is known to exist bearing such listing which that perform the function required by the Owner. In such case, apply for field inspection of such equipment. The Contractor is responsible for the payment of such inspection costs.

K. Power Rating
1. All devices provided under the Work of this Section that are connected to the Project electrical system shall provide stable performance in full accordance with these specifications when operated on main service which complies with ANSI standard tolerances for voltage, frequency, transients and related parameters.

L. Circuit Protection
1. All active devices shall have integral fuse or circuit breaker protection.
2. All circuit breakers shall be fully magnetic.
3. Protection devices shall be located to facilitate examination, resetting and/or replacement without the need to disassemble or demount the associated device.
4. Contractor-fabricated items shall be provided with either indicating type circuit breakers or fuses of the clear glass cartridge type, mounted in fuse holders which will indicate a blown or defective fuse.

M. Continuous Use

1. All active circuitry shall be solid state and shall be rated for continuous use. All circuit components shall be operated in full compliance with the manufacturer's recommendations and shall contain sufficient permanent identification to facilitate replacement.

N. Construction
   1. All electronic equipment shall be of the "dead-front" type and shall be designed for standard 19" EIA rack mounting, unless otherwise indicated.
   2. Steel frames and enclosures shall be designed and wired to eliminate all induced currents within both the units and the systems.
   3. All bolted connections shall be made with self-locking devices.
   4. Coordinate all consoles and panels so that the general appearance is similar, or as directed by the Owner.
   5. All operating panels shall be at least 1/8" thick aluminum.
   6. Provide locking panel covers on all recessed, semi-recessed or surface mounted control panels not located in the equipment rooms, unless specifically noted otherwise. Panel locks shall be flush with no protrusions beyond the panel face when the door is closed. Recessed control panels shall be recessed within the back box to a depth sufficient to permit a locking hinged panel cover to completely close without affecting any device within the enclosed area.

O. Circuit Boards/Modules
   1. All printed circuit boards or modules shall be mechanically secured by bolt or friction-loading guide, in addition to any electrical connector attachment, and shall include an integral extraction grip.
   2. Printed circuit boards shall be connected to associated circuitry via soldered connections or precious metal positively keyed card edge connectors.
   3. All Contractor-fabricated printed circuit boards shall be at least 1/16" thick G-10 glass fabric epoxy base, copper plated to a minimum density of 2.0 oz./sq. ft. on one or both sides, and finished with 60/40 tin/lead solder either hot rolled or plated over the copper. All holes through the boards shall be plated through and solder filled. All boards shall be permanently identified with a designation that matches that of the mating connector or board position in the assembly.

P. Identification
   1. Provide permanent intelligible identification on, or adjacent to, all connectors, receptacles, controls, fuses, circuit breakers, patching jacks, and the like. This identification shall clearly and distinctly indicate the function of the item and shall be numbered or lettered to correspond with the function, circuit and location consistent with field and shop drawings. Refer to section 3.5 for clarification.

Q. Modular Products
   1. The drawings show conventionally packaged components to convey design intent.
   2. Card cages to have front and rear closure panels to provide a finished appearance.
   3. Except as noted below, modules of different functional types are permitted to share the same card cage/mounting frame and/or power supplies as applicable and if mechanically and electrically compatible.
   4. With amplifier input driven 10 dB beyond input level required to produce full rated output, amplifier shall withstand indefinitely any of the following load conditions without instability of operation of main over current protection (i.e. no blown fuses or circuit breakers).
      a. "Short" circuit of 0.1 ohm.
      b. Open circuit (no load).
      c. Rated load impedance.
   5. Maintain sense of signal polarity from input to output.

R. Keys
   1. Key all boxes, cabinets, enclosures, panels, controls, doors and related provided for similar usage within a system identically. For each unique key type, provide a quantity of ten. Stamp each key with a reference designation. Provide a master keying system.

2. Submit a schedule of keying to the Owner. Where so noted, provide Project Standard lock cylinders and keys; coordinate with the work of other Sections.

S. Lectern Power Cord
1. The power outlet connecting the lectern to the floor box must be twist-lock type. The power cord connecting the podium to the floor box must be 12 inches shorter that the low voltage cable connecting it. This will protect the low voltage cable from damage if the podium was to be moved inadvertently without disconnecting the cables. The power cable shall include a wire-rope strain relief to keep the power cord from damage. See cable detail on plan-set for more information.

T. Assistive Listening System (RF)
1. An assistive listening system using wireless radio frequency (RF) transmitter and headsets will allow personal monitoring of the audio program for the hearing impaired. The transmitter will be a frequency agile unit with no less than 30-channel capability and will broadcast the main audio program to personal headsets used by hearing impaired audience members. The system and quantity of headsets supplied shall conform to the ADA requirements (section 219 and 706) for the space. Stereo headset type and hearing aid compatible (T-Coil) listening devices are required; ear-bud type devices are not acceptable. Supply a drop-in type battery charging system capable of servicing multiple receivers, with sufficient charging capacity to charge each receiver simultaneously. Follow the table below for quantity requirements.

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Hearing Aid Compatible Receivers
50 or Less	2	2
51 to 200	2, plus 1 per 25 seats over 50 Seats *1	2
201 to 500	2, plus 1 per 25 seats over 50 Seats *1	1 per 4 Receivers *1
501 to 1000	20, plus 1 per 33 seats over 500 *1	1 per 4 Receivers *1
1001 to 2000	35, plus 1 per 50 seats over 1000 seats *1	1 per 4 Receivers *1
2001 and over	55, plus 1 per 100 seats over 2000 seats *1	1 per 4 Receivers *1

*1 Or fraction thereof

U. Projection Screens
1. Provide extra screen material drop to locate the projection screen at the optimum viewing angle where required. Verify screen drop requirements with architectural sections and elevations.

V. Provide enclosure systems including, but not limited to racks, cabinets, cases and related panels and accessories as specified herein, or approved equivalent. Provide size and quantity as shown on drawings. Provide color as specified by Architect. If no color is shown on drawings, submit manufacturer's standard color chips for selection.

~~W. Cable Tray: Provide aluminum ladder style cable tray with flange in side rails where called out in drawings. Size the cable tray to accommodate all wire that must pass through it. Provide all supporting hardware and accessories.~~
~~1. Ladder Style Cable Tray~~
~~a. P-W Industries.~~
~~b. Equal by Hubbell.~~
~~c. Approved equal.~~ **ADD 2**

~~X. Floor Mounted Equipment Racks: Provide each bay with basic frame, vented locking rear door, top panel with single 10" fan, certified seismic floor anchor kit, ganging hardware, except where otherwise indicated, at each ensemble of bays, provide end (side) panels to provide complete enclosure.~~ **ADD 2**

1. ~~Rack cabinet, heavy duty welded 14ga. CRS, single bay of maximum dimensions 83-1/8"(H) x 24"(W) x 32.5"(D); floor supported with accessory louvered side rack side panel.~~
   a. ~~Mid Atlantic WRK Series.~~
   b. ~~Equal by Atlas/Soundolier.~~
   c. ~~Approved equal.~~
2. ~~Wall cabinet, tilt out:~~
   a. ~~Atlas/Soundolier AWR Series.~~
   b. ~~Mid Atlantic WRS Series.~~
   c. ~~Equal by House of Metal Enclosures (HOME).~~
   d. ~~Equal by Hammond Manufacturing.~~
3. ~~Wall Mounted cabinet:~~
   a. ~~Atlas/Soundolier 300 Series.~~
   b. ~~Mid Atlantic DWR Series.~~
   c.a. ~~Equal by Hammond Manufacturing~~.

~~Y.~~W. Rack Panels and Accessories: Rack Mounting Screws: Screws 10-32; length as required for at least 1/4" excess when fully seated; oval head with black plastic non marring cup washer or equivalent ornamental head; nickel, cadmium or black plated; Phillips, Allen Hex, Square-Tip or Torx drive. Slotted screws are not acceptable. **ADD 2**

1. Blank Panels:
   a. Atlas/Soundolier S19 Series.
   b. Zero ZP112000 Series.
   c. House of Metal Enclosures (HOME) Series PM.
   d. Middle Atlantic Products BL, SB or HBL Series.
2. Vent Panels:
   a. Middle Atlantic ETF Series.
   b. Equal by Atlas/Soundolier.
   c. Equal by Zero.
   d. Equal by House of Metal Enclosures (HOME).
3. Shelf:
   a. Middle Atlantic Products U Series.
   b. Atlas/Soundolier SH19 Series.
   c. Zero A52 Series.
4. Drawer:
   a. Atlas/Soundolier SD Series.
   b. Middle Atlantic Products UD Series.
   c. House of Metal Enclosures (HOME) SD Series.
   d. Zero A43/A36 Series.
5. ~~Compact Disc Holder: Middle Atlantic Products Model RSH-4A.~~ **ADD 2**
6. Rackmount Computer Keyboard: Middle Atlantic RM-KB.
7. Equipment Custom Rackmount Shelf: Middle Atlantic Products Model RSH-4A Series.
8. ~~Rackmount Computer Keyboard.~~ **ADD 2**
   a. ~~Mid Atlantic RM-KB series.~~
   b. ~~Approved equal.~~
9. ~~Computer Monitor Rackmount.~~ **ADD 2**
   a. ~~Mid Atlantic RM-MM series.~~
   b. ~~Approved equal.~~
10.8. Horizontal Lacer Bars **ADD 2**
   a. Mid Atlantic LBP-IR4, LBP-1S, LBP-1P.
   b. Equal by Atlas/Soundolier.

~~Z. Equipment Enclosure Ventilation: Provide UL Recognized devices. Connect to enclosure power, comply with applicable Codes.~~ **ADD 2**

1. ~~Fan panel, 5-1/4" high painted steel rack panel with 4" diameter fans, each fan with chrome plated finger guard, low speed air flow, two fans per panel, total 120 CFM:~~
   a. ~~Mid Atlantic QFP-2 Series.~~

~~b. Atlas/Soundolier ES/IS Series.~~
~~c. BGW Systems.~~

~~2. Thermostatic Fan control module, user definable temperature range with status LED's, temperature sensing probe.~~
~~a. Middle Atlantic FC Series.~~
~~b.~~c. ~~Atlas/Soundolier CFT Series~~.

~~AA.~~X. Equipment Enclosure Power and Signal Grounding: Comply with applicable Codes and applicable portions of Division 26. Provide UL Listed devices, Specification or Hospital Grade. Provide all junction boxes, raceway, fittings, wire, supports and fastenings as required for complete installation. Unless otherwise noted, provide receptacles of NEMA 5-15R configuration.

1. Full height receptacle strip, Isolated Ground: **ADD 2**
   a. Wiremold 3000 Plugmold IG Series.
   b. Middle Atlantic PD series vertical power strips.
2. Full height receptacle strip, three or more circuits, Isolated Ground:
   a. Wiremold 3000 Series with Specification Grade IG 5262 Series receptacles.
   b. Middle Atlantic PD series vertical power strip.
3. Wireway, lay in, NEMA 1: Any meeting NEMA 1 and UL870. Size as required.
4. Flexible metal conduit: Comply with Division 26.
5. Sequencing Power System:
   a. The Contractor is to design and build power sequencing and surge suppression systems that will control and distribute power in the equipment racks. The system will be designed to sequentially connect power to all of the audio-visual equipment in the equipment racks. Outlets are mounted to the unit's back plate or on a remote strip. If the project utilizes a control system, the sequencing power system will be controlled by the software configurable control system. The touch panel's shut down button will prompt a second time asking "Are you sure you want to shut the system down?" A positive response will activate system shut down. A push button control station's shut down button will be pressed twice to shut down the system. If the project does not include a control system, the Contractor is to provide a dedicated sequential controller in the equipment racks.
      1) 15 amp or greater power capacity.
      2) 3-prong 15 amp 120VAC isolated ground outlets (provide required amount).
      3) Individual sequencing steps for each outlet.
      4) Adjustable power-up time delay and outlet sequencing intervals.
      5) Modular power raceway systems shall be constructed of 18-gauge min-spangle galvanized steel.
      6) Remote controllable via contact closures (if applicable).
      7) Status indicator on touch panel (if applicable).
   b. Approved subject to above:
      1) Middle Atlantic RLM-XX, RM-XX, R-XX or M-XX Modular Power Raceway Series.
      2) Middle Atlantic USC-6R Universal Sequencing Controller.
      3) Equal by Atlas Soundolier.
6. Signal Grounding bus bar, insulated from enclosure frame:
   a. Atlas/Soundolier BBG Series mounted on standoff insulators.
   b. Zero A32 Series.
   c. Middle Atlantic.
   d. Panelboard Isolated Ground bus kit by manufacturer of Project Panelboards specified in Division 26.
7. Multi-Outlet Assembly, Surge Suppressing, UL Listed. Comply with ANSI/IEEE C62.41-1980. Provide at least six receptacles. Provide equivalent to:
   a. Surgex SX RT series.
   b. EFI Electronics Corporation Model 153.
   c. MCG Electronics, Inc. Model 296 (subject to UL Listing).

8. Computer Grade Uninterruptible Power System, UL Listed. Provide continuous, no-break power with sine wave output. Provide Transient Over-Voltage (TOV) Surge Suppression; comply with ANSI/IEEE C62.41-1980, Category A and Category B. Provide complete isolation from Line. Provide output voltage regulation to ANSI C84.1 for computing equipment. Provide output KVA, switch-mode power supply rated, not less than 150% of connected load indicated. Provide one for each Central Processing Unit, Digital Signal Processor and automated control console. Provide equivalent to:
   a. Best Power Technology, Inc. "Micro-Ferrups" Series.
   b. Best Power Technology, Inc. "Axxium" Series.

~~BB. Data Patching and Related:~~ **ADD 2**

1. ~~Data Patching Jack Assemblies; jackfield two times twenty four (2x24) jacks. Meet or exceed Category 6 requirements described in TIA/EIA-568-C.2-1 as well as the Class E requirements described in ISO/IEC 11801-B.:~~
   a. ~~Leviton eXtreme 6+ Quickport Patch Panel (or equal).~~
2. ~~Provide patch cords for patch points as required.~~

~~CC. Fiber Patching and Related:~~ **ADD 2**

1. ~~Fiber Patching Jack Assemblies. Meet or exceed all TIA/EIA-568-C requirements:~~
   a. ~~Leviton Opt-X Ultra Fiber Rack Mount Enclosure (or equal).~~
2. ~~LC type adapters.~~
3. ~~Provide patch cords for patch points as required.~~

2.2 PRODUCTS

A. Major System Components **ADD 2**

DEVICE_ID	DESCRIPTION	MANUFACTURER	MODEL	ACCESSORIES
ALA	ASSISTIVE LISTENING ANTENNA	WILLIAMS SOUND	ANT 034	
ALR	ASSISTIVE LISTENING RECEIVER	WILLIAMS SOUND	PPA SELECT PPA (R37)	HED 021
~~ALS~~	~~PORTABLE CASE~~	~~PELICAN~~	~~1450~~	
ALT	ASSISTIVE LISTENING TRANSMITTER	WILLIAMS SOUND	PPA T45	
~~ANT~~	~~ANTENNA~~	~~SHURE~~		
BDP1 (OFCI)	BLU-RAY DISC PLAYER	~~SONY~~	~~BDP-S1500~~	
CAM	POE CAMERA	AXIS	P5515 PTZ	T94A03L RECESSED CEILING MOUNT KIT
CPU (OFCI)	CENTRAL PROCESSING UNIT	~~DELL~~		
CT1	CONTROL	EXTRON	MLC 104 IP PLUS~~100~~	
CVM (OFCI)	COMPUTER VIDEO MONITOR	~~DELL~~		
DC (OFCI)	DOCUMENT CAMERA	~~ELMO~~	~~TT-12iD~~	
HS	FOLDING HEADPHONES	WILLIAMS SOUND	HED 021	
KB (OFE)	KEYBOARD			
LEC1(OFCI)	LECTERN	SPECTRUM INDUSTRIES	55357BKBS10112010	
LPM	LAPEL MICROPHONE	SHURE	WL185	

M (OFE)	MOUSE	MICROSOFT COMPATIBLE		
DEVICE_ID	**DESCRIPTION**	**MANUFACTURER**	**MODEL**	**ACCESSORIES**
M1	MICROPHONE INPUT	FSR	T3-MJ	
MIC1	MICROPHONE	SHURE		
NI1	NETWORK INTERFACE	GLOBAL CACHE	GC-100-06	
NI2	NETWORK INTERFACE	GLOBAL CACHE	IP2CC	
NL	NECK LOOP	WILLIAMS SOUND	NKL 001	
~~PA100/2V~~	~~POWER AMPLIFIER~~	~~EXTRON~~	~~XPA 1002 70V~~	-
~~PA30/2V~~	~~POWER AMPLIFIER~~	~~EXTRON~~	~~MPA 152 PLUS~~	
PEC#	PORTABLE EQUIPMENT CASE	PELICAN	1450	
PJS1	PROJECTION SCREEN	DRAPER	ACCESSFITV	IMAGE AREA 8.5' X 5.3'
RX1	RECEIVER	EXTRON	DTP HDMI 4K 230 Rx	
SC1	CEILING SPEAKER	ATLAS SOUND	FAP63T	
SYSW1	SYSTEM SWITCHER	EXTRON	IN 1608 MA 70	
TTP1	TABLE TOP PANEL	EXTRON	CABLE CUBBY 7~~5~~00	WITH INSERTS
TTP2	TABLE TOP PANEL	EXTRON	CABLE CUBBY 202	WITH INSERTS
TX1	TRANSMITTER	EXTRON	DTP T DWP 4K 232 D	2 GANG BOX FOR UNDER TABLE MOUNTING
TX2	TRANSMITTER	EXTRON	DTP HDMI 4K 230 Tx	
VD50	VIDEO DISPLAY	NEC	E505	CHIEF LSM1U MOUNT AND REQUIRED HARDWARE, CHIEF PAC138
VD70	VIDEO DISPLAY	NEC	E705	~~BMS~~ CHIEF LSM1U ~~CTAWA-LOCII~~ AND REQUIRED HARDWARE, CHIEF PAC138, NEC OPS SB-03TM
VPJ1	VIDEO PROJECTOR	CASIO	XT-UT310WN	BMS CTAWA-LOCII MOUNT AND REQUIRED HARDWARE
VPJ2	VIDEO PROJECTOR	CASIO	XJ-M246	BMS CTAWA-LOCII AND REQUIRED HARDWARE
WB	WIRELESS BELT-PACK	SHURE	UR1	
~~WLMC~~	~~PORTABLE CASE~~	~~PELICAN~~	~~1450~~	
WMR1	WIRELESS MIC RECEIVER	SHURE	ULSX4	

B. The above list of Major System Components only outlines the major items necessary to allow the system to function as designed. It lists no power supplies, balancing transformers, power splitters, modular cards or other auxiliary components required to achieve a functioning system. Contractor is required to supply all components needed to provide a complete and operable system as outlined in the contract documents. The full set of construction documents are to be used when preparing a bid. This list is not intended to provide a full bill of materials.

C. Patch bays shown on plans and elevations are for placeholder information only. Contractor is to determine the exact amount of patch needed as per single line diagrams.

2.3 FINISHES

A. Any item or component of the Work of this Section which is visible shall comply with the following. Finishes noted or scheduled on the Contract Drawings shall take precedence. Submit all color samples of all items visible to public for approval.
   1. Where finishes are not noted or otherwise defined in the Contract Documents, submit manufacturer's standard finish samples for selection by the Owner.
   2. Paint loudspeaker cabinets to match exactly the surrounding and adjacent surfaces. Submit paint sample to Owner's representative for approval.
   3. Unless otherwise noted, receptacle or device plates subject to connection or operating force shall be stainless steel or hard anodized aluminum. Provide plates which generally match the appearance of project standard receptacle or device plates in view in the same area. For anodized aluminum, submit samples of standard colors for selection by Owner.
   4. Operating panels shall be steel, primed, painted with thermosetting epoxy paint, with legends silk-screened in contrasting color, and coated with clear epoxy thermosetting coating; or aluminum, hard anodized, with legends engraved and filled with contrasting color, all coated with clear epoxy thermosetting coating.
   5. All steel surfaces shall be treated with primer equivalent to zinc phosphate and finish painted with baked enamel or painted with a thermo setting epoxy paint.
   6. All aluminum surfaces, except those used as operating surfaces, shall be anodized and then painted with a thermo setting epoxy paint.

B. Custom Fabricated Plate Screws
   1. Match the finish of the screws used to mount the custom fabricated plates with the finish of the custom fabricated plate.

C. Ceiling Loudspeaker Grilles
   1. Paint loudspeaker grilles to match exactly the surrounding and adjacent surfaces (when speakers are recessed). Apply paint to permit servicing of loudspeakers without damage to finish of adjacent or adjoining surfaces. Provide uniform appearance. Do not obstruct grille openings with paint. Submit paint sample to Owner's representative for approval.

D. Manufacturer's logos
   1. Remove all manufacturers' names, logos, or other symbols from speakers or other objects placed in view of the public.

2.4 ALTERNATIVES AND SUBSTITUTES

A. Substitutions of equal equipment beyond the alternatives listed will be permitted only in accordance with Division 1. If a requested substitution requires a change in any of the contract drawings, a revised drawing must be submitted as part of the substitution request. The Owner's Representative will be the final judge of the acceptability of substitutions. The burden of proof of equivalence is the responsibility of the Contractor.

B. Acceptance of a product shall not, in any form or manner, relax the system performance requirements of this Specification and the performance characteristics of the product.

C. The Contractor shall submit for review a complete list of proposed substitutions for approved equipment listed in Part 2.

D. For all substitutions, the Contractor shall provide the manufacturer's independent test data to demonstrate that the proposed alternatives to the approved equipment comply with the specifications. Specifications shall contain at least all information available for the specified product.

E. The Contractor shall submit a description and drawings showing all changes to the Contract Documents that the proposed substitution will require for proper functionality and operation.

F. Proposed substitutions shall not affect dimensions shown on the Contract Document except as submitted for review and approved by the Owner.

G. Any redesign or construction costs required to integrate the proposed substitution shall be the responsibility of the Contractor. Any costs incurred by the Owner, Owner's representatives, Architect, Engineers or Consultants attributable to the integration of a proposed substitution shall be borne by the Contractor.

H. Any proposed substitution shall have no adverse effect on other trades, the construction schedule or specified warranty requirements.

I. The functionality, performance, general appearance and quality of the proposed substitution are equivalent to or superior to those of the specified item.

J. Any change to the Contract (deductive or additive cost) associated with a proposed substitution shall be submitted to the Owner for review at the time the substitution is proposed and accompanying a substitution request documentation.

K. The Contractor will provide the same warranty for the substitution that the Contractor would for the specified product.

L. The Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects equal to the designed system before the substitution was made. In the event that the substituted material or equipment fails to meet performance testing standards after installed, the Contractor will replace substituted material or equipment with those initially specified.

PART 3 - EXECUTION

3.1 GENERAL

A. Perform the Work of this Section in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein.

B. Furnish and install (herein, "provide") all materials, devices, components, and equipment required for complete, operational systems.

C. Contractor is to supervise the installation of back boxes and terminal cabinets installed by the Division 26 Contractor. Contractor is to verify that correct boxes are installed in their proper locations before any drywall has been installed.

3.2 EXAMINATION

A. Immediately report to the Consultant any discrepancies between the specifications and drawings. This includes discrepancies between the technical specification documents and actual field dimensions or findings that may hinder installation work, conflict with other trades, or cause delays.

B. Carefully examine all details that affect all aspects of the systems described in the specifications and drawings.
   1. Examine, coordinate and confirm all drawings and details.
   2. Examine, coordinate and confirm all electrical power requirements, conduits, raceways, boxes, and etc.
   3. Examine, coordinate and confirm work of other trades that may influence the outcome of the design, specification, and performance of the systems.

3.3 PREPARATION

A. This installation section is only meant as a guideline for the Contractor. The Contractor shall be responsible for executing all installation work in a manner that is in accordance to industry-accepted standards or governing codes, whichever is more stringent. Installation activities shall be executed in an organized and orderly manner. These steps include, but are not limited to, pre-delivery testing, delivery, unloading, installation, equipment / cable labeling, programming, set-up / calibration / alignment / adjustment, testing, commissioning, training, and documentation.

B. Protect all existing work surfaces, furniture, equipment, fixtures and etc. before commencing installation work. Any damage to the existing physical and electrical property due to installation work shall be the responsibility of the Contractor.

C. Immediately hand over any de-installed equipment to the Owner for disposal or safe-keeping.

D. Carefully remove any obstructions such as fixed seating, ceiling tiles, furniture, equipment and etc. that would obstruct or hinder the installation work. Damage caused by undue care in moving these items shall be responsibility of the Contractor.

E. Examine, coordinate, and confirm the cleanliness of the work site before commencing the portion the installation work that involves dust-sensitive electronic or electrical equipment such as audio mixers, switchers, projectors, control processors, computers, cameras, etc. Dust-sensitive equipment that is installed in a work site with a lot of air borne dust and dirt shall be properly protected. For example, a video camera on a wall-mounted bracket is protected by a clean plastic bag to prevent dust from contaminating it. Seal the bag's opening using adhesive tape.

F. Prior to commencing installation work, ensure that the surrounding areas are clean and promote ease of installation work.

G. Ensure that all equipment rack and equipment locations are clean before commencing installation work.

H. Unless specified otherwise, furnished products / equipment shall be tested, delivered and installed. And, all systems shall be tested and commissioned to fully operational and properly configured condition.

I. All electrical equipment shall be burned-in or tested at the Contractor's shop before delivery. This pre-installation test shall reveal any equipment that is faulty, malfunctioning or dead out of the box ahead of time.

J. All radio frequency (RF) operated devices shall be tested on-site prior to installation to determine blind spots, RF interference, or any other transmission / reception problems. The Contractor shall be responsible for costs associated with providing additional support or accessory equipment (antennas, amplifiers, cables, etc.) and / or services to improve signal transmission / reception.

K. Provide all support equipment (ladders, man-lifts, tools, etc.) required to complete the installation work in a safe and expeditious manner.

L. Obtain any plan approvals, permits and licenses required by inspection authorities prior to execution of any installation work. The Contractor shall be responsible for all associated fees and costs incurred while fulfilling this requirement.

M. Ensure that all equipment is accessible for operation and maintenance work. Under no circumstance shall equipment be inaccessible or inconveniently located.

N. Aside from the systems' operational features, provide equal attention to the overall aesthetics of the installed equipment and cabling. Special attention to aesthetics shall be extended to equipment or cabling in public spaces.

O. Firmly secure all fixed equipment and hardware in place and ensure that they are plumb and / or square. An exception to this shall be portable or movable equipment.

P. Structurally mounted equipment: All equipment shall be mounted in accordance to all applicable safety codes, standards and practices. The one that provides for the most stringent rule shall prevail. All mounting hardware shall have a load rating by, at least, a factor of 5 (500% or greater) in reference to the weight of the equipment to be mounted or suspended. An exception to the rule shall be existing local safety codes or standards requiring greater load capacities.

Q. Seismic restraints: Abide by all the seismic restraint requirements described in all applicable building codes in force at the work site. If no provisions exist for a particular situation, follow these minimal recommendations.
   1. Fixed equipment: Mount and brace to the building structure to minimize potential hazards to personnel and damage to property during any kind of seismic event.
   2. Floor mounted equipment: Bolt equipment securely to the floor to prevent from toppling during any kind of seismic event
   3. Vertical-mounted columns: Apply braces to the vertical column in four opposing directions back to the mounting surface. This will minimize sway in any direction. Provide a separate, flexible restraint (e.g. aluminum braided aircraft cable) with a capacity of 5 times the weight of the total mounting system. The same applies to the anchor to which the flexible restraint is attached and the method of attachment to the structure.
   4. No equipment, equipment supports, or mounts must fail before the structure fails.
   5. Seismic restraint measure must not interfere with fire stopping.
   6. Notwithstanding compliance with these minimum recommendations, it is the Contractor's responsibility to ensure that the seismic restraint measures taken are adequate for the circumstances, including, if required, verification by an independent structural engineer. The cost of all such engineering shall be the responsibility of the Contractor.
   7. Penetration of the Slab: Verify that any mounting or restraint work that requires deep or thorough penetration of the slab shall not damage embedded materials including, but not limited to, slab tensioning devices or conduit. Verify the slab by X-ray or other method before proceeding. The Contractor shall be responsible for all costs associated with this investigation.

3.4 INSTALLATION

A. Follow manufacturer's instructions for installing, operating, configuring, and programming their equipment. Do not perform modifications to equipment that would void its warranty.

B. Pull and terminate all cables, and interconnect all equipment and components in accordance with approved drawings. Install audio-visual cover plates and faceplates onto all boxes.

C. Loudspeaker Assembly Installation
   1. Loudspeakers:
      a. Verify proper installation of loudspeaker enclosures and related support.

b. Verify that no loudspeaker assembly is subjected to stresses or loading effects in any way contributing to possible extraordinary failure.
c. Connect loudspeaker assemblies to the appropriate 70 volt-line transformer tap as applies. Verify specified polarity. Use insulated crimp connectors or insulated "bobtail" splices applied with manufacturer's recommended ratchet tooling. Wago Wall-Nuts 773 Series or equal are acceptable. Wire nuts or "Scotchlock" connectors shall not be acceptable.
d. Verify that loudspeaker grille openings and loudspeaker components are clear of paint after finishing.
e. Perform preliminary loudspeaker tests specified herein. Correct non-conforming conditions.
f. Adjust 70 volt-line transformer taps as required to realize uniform sound pressure level as specified herein. Document final 70 volt-line transformer taps on the Record Drawings.
g. Correct all conditions giving rise to noise, rattle or other extraneous sounds owing to operation of a loudspeaker assembly under any specified operating condition.

D. Video Projectors
1. Projectors shall be centered laterally to the projection screens.
2. Projectors shall be mounted such that digital keystone compensation shall not be required.
3. Selected projectors shall have lamp replacement and filter cleaning doors located in such a way that these items may be serviced while the projector is installed.
4. Projectors shall be mounted such that their optical zoom settings shall not be set at either their widest nor narrowest extreme, but shall be used in their mid-range.

3.5 LABELING AND IDENTIFICATION

A. All cables and connecting blocks shall be clearly, logically and permanently marked and identified by the following means:
1. Use cable labels similar to the Panduit Polyolefin Self-laminating Labels for inkjet or laserjet printers or any other means acceptable to the Consultant. Cable labels should be machine printed and not handwritten.
2. Cable labels should be placed approximately 12 cm. from each end of the cable.
3. Labeling conventions shall be clear, logical, and must be acceptable to the Consultant.
4. Include all cable identification numbers on all wiring diagrams and cable schedules.
5. For fiber optic cables, use cable identification products such as the Panduit Labelcore series or any other means acceptable to the Consultant.
6. For connector and terminal blocks, label using any means acceptable to the Consultant.

B. All cover plate, switches, panels, outlets, etc. labeling shall be engraved and filled, or silk-screened or by any other means acceptable to the Consultant. Do not use Dymo, Brother, or other similar labeling products.

C. Protective Devices
1. Identification of fuses and circuit breakers shall indicate protected circuitry, rating of protective device and voltage across open circuited protected device.

D. Panels and Receptacles
1. Panel surfaces shall be engraved and filled or silk screened with identification, or shall be provided with 1/16 inch (minimum) thick laminated plastic labels with engraved block characters at least 1/8 inch high fastened to the equipment by stainless steel screws or rivets. Provide white characters on black background unless otherwise noted. Embossed plastic (Dymo) labels shall not be acceptable.

E. All equipment shall be labeled in a clear, logical manner or by any other means acceptable to the Consultant.

1. For Control Knobs and Sliders: Use 6mm (1/4") round labels, such as the Avery 057xx series, to indicate level settings. Neatly draw an arrow on the label using a fine tip permanent marker to accurately indicate the position of the control knob. If a control knob or slider has multiple level settings, use a logical and consistent color scheme to identify each setting. Illustrate all equipment settings in the Operation Manual.
2. For equipment identification, use 'badges' made of aluminum or plastic or any other acceptable material with engraved and filled, or silk-screened labeling. Stick these badges using industrial-strength doubled-sided 3M adhesive tape. Note: Label schemes should be clear, logical, and simple or by any other means acceptable to the Consultant. Indicate equipment labeling schemes on all elevation and plan drawings showing the front and / or rear of the equipment racks. The reader should be able to easily reference the label description to specific equipment in the Operation and / or Maintenance Manuals.

3.6 WIRING

A. General
   1. This section does not apply if the drawings incorporate a wire schedule.

B. Audio Signal Wiring Classification:
   1. Type A-l: Microphone level wiring less than -30 dBu, 20 Hz to 20 kHz.
   2. Type A-2: Line level wiring -30 dBu to +24 dBu, 20 Hz to 20 kHz.
   3. Type A-3: Loudspeaker level or circuit wiring greater than +24 dBu, from 20 Hz to 20 kHz.

C. Video/Graphics and Related Signal Wiring Classification:
   1. Type V-1: Baseband and composite video wiring 1 volt peak-to-peak into 75 ohms, 0 to 100.0 MHz.
   2. Type V-2: Synchronization and switching pulse wiring 4 volts peak-to-peak into 75 ohms, 15.62 to 15.75 kHz.
   3. Type V-3: Color subcarrier wiring 0 to 4 volts peak-to-peak into 75 ohms, 3.57 to 4.43 MHz.

D. Control Signal Wiring Classifications:
   1. Type C-1: DC control wiring 0 to 50 volts.
   2. Type C-2: Synchronous control or data wiring 0 to 40 volts, peak-to-peak.
   3. Type C-3: AC control wiring 0 to 48 volts, 60 Hz.

E. Additional Wiring Classifications:
   1. Type M-1: DC power wiring 0 to 48 volts.
   2. Type M-2: AC power wiring greater than 50 volts, 60 Hz.

F. Wiring Combinations: Except as indicated herein, conduit, wire ways and cable bundles shall contain only wiring of a single classification. The following combinations are acceptable in conduit, or cable harnesses. Additional acceptable combinations may be indicated on the Contract Drawings.
   1. Types A-1, C-1, and M-1.
   2. Types A-2, C-l, C-2, and M-l, runs less than 20 feet.
   3. Types A-2, C-1, and M-1.
   4. Types A-3, C-1, C-2, and M-1.
   5. Types A-2, V-1, and V-3.
   6. Types V-1, V-2, V-3, and C-1.
   7. Types M-2 and C-3.

3.7 WIRE AND CABLE INSTALLATION

A. Provide permanent identification of run destination at all raceway terminations.

B. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.

C. All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels, connector shell or equipment enclosures.

D. Within buildings, make splices only in designated terminal cabinets and/or on designated equipment backboards. Outside buildings, make splices only in designated manholes and/or hand holes. Protect splices outside of buildings with splicing kits equivalent to Scotch-cast Re-enterable. Make splices only with connectors or terminal devices specified herein. Document all splices on Record Drawings.

E. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable.

F. Inspect all conduit bends to verify proper radius. Comply with Code for minimum permissible radius and maximum permissible deformation.

G. Apply a chemically inert lubricant to all wire and cable prior to pulling in conduit. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

H. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Provide tool formed thermal expansion loops at cable at manholes, handholes and at both sides of all fixed mounted equipment. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.

I. Secure all wire and cable run vertically for continuous distances greater than 30 feet. Secure robust non-coaxial cables with screw-flange nylon cable ties or similar approved devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.

J. All Category type cable, connectors and plugs shall be color coded for easy visual distinction. Color coded insert type boots shall be installed on all Category type plugs. A colored coded ring will be provided on all chassis connectors (i.e. Neutrik ACRF-#). Cable connecters shall be equipped with Neutrik BSE-# color coded bushings. The Color code shall be as follows:
   1. Digital Video / AV UTP =Green
   2. LAN =Yellow
   3. Audio Network =Red
   4. AV Local Area Network =Orange
   5. Digital Media =Blue
   6. Computer Training KVM =Grey
   7. AV UTP =White

3.8 CONNECTOR AND SIGNAL POLARITY CONVENTION

A. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system. Where applicable, a positive polarity electrical signal shall yield positive acoustic pressure from the loudspeakers.

B. Audio signal connector convention: AES14-1992 (ANSI S4.48-1992) AES standard for professional audio equipment - Application of connectors, Part 1, XLR-type polarity and gender.

Signal	Connector	Wire
Signal Phase	Pin 2	Red or White
Signal Anti-Phase	Pin 3	Black
Signal Ground	Pin 1	Drain Wire

C. Video and RF/MATV Connector Convention:

Signal	Connector	Wire
Signal Phase	Center Pin	Center conductor
Signal Anti-Phase	Shell	Shield
Signal Ground	Shell	Shield

D. Voice/Data Connector Convention: Comply with EIA/TIA-568C.

3.9 WIRING PRACTICE

A. Land all non-coaxial field wiring entering each equipment rack at specified terminal devices prior to connection to any equipment or devices within racks. At Contractor's option, such terminals may be located in the equipment racks or at backboards provided. Coordinate such selection with Project construction sequence and test procedures specified herein.

B. Identify all wire and cable clearly with permanent labels wrapped about the full circumference within one inch of each connection. Indicate the number designated on the associated field or shop drawing or run sheet, as applies. Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Provide any of the following:
   1. Continuous permanent imprint; equivalent to Clifford of Vermont, Inc. "Quik-Pull".
   2. Direct hot stamp.
   3. Heat shrinkable factory hot stamped; equivalent to Brady sleeve Heat shrink.
   4. Adhesive strip printed labels wrapped the full circumference of the wire and sealed with clear heat shrink tubing; equivalent to Thomas and Betts or Panduit Insta-code with clear heat-shrunk tubing equivalent to Alpha.

C. Apply all crimp connectors only with manufacturer's recommended ratchet type tooling and correct crimp dies for connector and wire size. Plier type crimp tooling shall not be acceptable.

D. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer's recommendations. Make connections with automatic impact type tooling set to recommended force.

E. Make all connections to screw-type barrier blocks with insulated crimp-type spade lugs. Lugs are not required at captive compression terminal type blocks. Provide permanent designation strips designed for use with the terminal blocks provided. Make neat, intelligible markings with indelible markers equivalent to "Sharpie".

F. Tin terminated shield drain wires and insulate with heat shrinkable tubing.

G. Use only rosin core 60/40 tin/lead solder for all solder connections.

H. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point. Provide service loops where harnesses of different classes cross, or where hinged panels are to be interconnected.

I. Termination and build out resistors and related circuit correction components shall be visible. Do not install in connector shells or internally modify equipment. Show locations on Record Drawings.

J. Correct any and all of the following unacceptable wiring conditions:
   1. Deformed, brittle or cracked insulation.
   2. Insulation shrunken or stripped further than 1/8-inch away from the actual point of connection within a connector, or on a punch block.

3. Cold solder joints.
4. Flux joints.
5. Solder splatter.
6. Non-grommet, non-bushed, or non-insulated wire or cable entries.
7. Deformation or improper radius of wire or cable

3.10 SIGNAL GROUNDING PROCEDURES

A. Comply with National Electrical Code.

B. Unless otherwise noted maintain a unipoint ground scheme.

C. Signal and electrical system grounds shall be isolated except at the Project ground field connection.

D. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.

E. Ground and bond equipment racks and similar equipment enclosures containing powered equipment exclusively via the Isolated Ground conductors provided under Division 26. INSULATE RACK MOUNTING, ANCHORAGE, AND RACEWAY CONNECTIONS.

F. At each rack, provide an Isolated Ground bus within the rack. At each rack, provide a lug bonded to the rack frame with a #8 TW stranded wire to the rack Isolated Ground bus.

G. At each ensemble of racks, provide a single labeled Isolated Ground tubular-clamp bus bar terminal strip to land the individual rack Isolated Ground bus ground conductors. Connect the main Isolated Ground conductor from the Technical Power panel board at this point.

H. Equipment signal ground shall be to the Isolated Ground System via the green wire of the equipment power cord. Where equipment uses two wire power cord, provide #12 green bond wire to rack IG bus bar. At equipment, provide crimp lug and suitable hardware for bonding.

I. Shielded cables of this section shall be grounded exclusively to Isolated Ground by a single path. Shield shall be tied to Isolated Ground at one end only, i.e., at the low potential (receiving) end of run, unless otherwise noted.

J. Unless otherwise noted, at audio jackfields, tie source shield at jackbay frame. Float shields at connections to output jacks. Bus each row of jack frames and run individual #12 green ground wire for each row to rack IG bus bar.

K. Signal Ground provisions shall realize less than 0.15 ohms to the primary ground connection.

3.11 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT BACKBOARD FABRICATION

A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.

B. Within each equipment enclosure, provide a full-height multi-circuit ISOLATED GROUND outlet strip with branch circuit count as shown on drawings; locate on the left side of the equipment enclosure, as viewed from the rear. In each enclosure provide number of receptacles required by present and future equipment indicated on drawings, plus at least two spare receptacles. Provide flexible steel raceway and junction box for connection of power service. Bond internal raceway to rack frame.

C. Provide a permanent label on the front of each equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.

D. Maintain separation of wiring classifications as specified herein. Separately dress, route and land microphone and line level cables and related on the right side of the equipment enclosure, as viewed from the rear; dress, route, and land loudspeaker level and control cables on the left side of the equipment enclosure, as viewed from the rear.

E. Access shall not require demounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.

F. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop locks to hold all hinged panels and drawers in a serviceable position.

G. Provide permanent labels for all equipment and devices. Where possible, fasten such labels to the rack frame or to blank or vent panels which will remain in place when active equipment is removed for possible service.

H. At jackfields, provide service loop to permit removal of jackfields from rack sufficient to conveniently access all jack contacts for routine cleaning and maintenance. Organize the service loop and harness such that reasonable reconnection of jacks and jack normals is possible without cutting apart the harness.

I. Coordinate the design and execution of wire harnessing of multi-bay rack ensembles with conditions of delivery to installation locations at Project Site, and with the requirement herein for test of the completely wired system in the shop prior to delivery to the Project Site. Organize the wiring harnesses such that they will fold within one shippable unit without risk of damage, or provide polarized multipin connectors and related interconnect systems as specified elsewhere herein.

J. At each equipment backboard, provide UL Listed surge suppressing multi-outlet assembly with at least six receptacles.

3.12 ADJUSTING AND TESTING

A. Test Equipment
   1. Furnish, store and maintain test equipment at the fabrication shop and the job site for both routine and Acceptance Testing of the Work of this Section. Maintain all test equipment at the job site while work is in progress from installation of equipment racks until Owner Acceptance of this Work; thereafter remove all of this test equipment from the job site. Provide all required test cables, jigs and adapters. Provide at least one of the following items or approved functional equivalents:
   2. Audio Systems:
      a. Wide Band Oscilloscope (Tektronix THS700 Series).
      b. True RMS Analog / Digital Volt-Ohm Multimeter (Fluke 187 Series or equal).
      c. Low Distortion Audio Frequency Sine Wave Oscillator (Gold Line TS1).
      d. Measurement Microphones (Earthworks M30, Bruel & Kjaer 4007, Josephson 550).
      e. Sound System Optimization and Acoustic Measurement Analyzer (Goldline TEF, Meyers SIM, SIA Smaart, WinMLS, EASERA).
      f. Harmonic Distortion Analyzer (Sound Technology or Tektronix AA 501A) or Swept Spectrum Analyzer, HP 3580A, or Swept Test System, Audio Precision or Neutrik).
   3. Video Systems:
      a. Wide Band Oscilloscope (Tektronix THS700 Series).
      b. Sync & Test Generator (Tektronix 1470).
      c. Waveform/Vector Monitor (Tektronix 1740).
      d. Color Picture Monitor, Precision.
   4. Communications and Related:
      a. Level II, Cat5e Cable Pair Tester (Microtest, HP, Scope, Fluke or Siemons set up to meet Category 5e parameters).

b. Outside Plant Voice Cabling Plant Tester – capable of detecting shorts, opens, reversals, mis-wiring and crosstwists (Siemon STM-8 or equal by Mod-Tap).
c. Metallic cable pair tester (Wavetek Corporation, Instruments Division, model LANTech 100).
d. Tone Test Set.
e. Optical Time Domain Reflectometer (OTDR) for fiber optics.
f. Any other items of equipment or materials required to demonstrate conformance with the Contract Documents.

B. System Performance Testing and Adjusting Procedures
1. Upon completion of the installation of all equipment in an area, perform the following tests and record results. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report. Correct all non-conforming conditions prior to requesting Acceptance Review and Testing. Perform at least the following procedures:
2. Mechanical: Verify:
   a. Integrity of all support provisions.
   b. Absence of debris of any kind, tools, etc.
3. Power and Isolated Ground: Verify:
   a. Isolation of Isolated Ground system from raceway and related ground.
   b. Grounding of devices and equipment. Integrity of signal and technical power system ground connections.
   c. Proper provision of power to devices and equipment.
4. Signal Wiring: Verify:
   a. Integrity of all insulation, shield terminations and connections.
   b. Integrity of soldered connections. Absence of solder splatter, solder bridges.
   c. Routing and dressing of wire and cable.
   d. Continuity, including conformance with wire designations on running sheets, field and shop drawings.
   e. Absence of ground faults.
   f. Polarity.
5. Use the proper sequence of energizing systems to minimize the risk of damage.
6. Audio Systems:
   a. Electronic Tests; confirm:
      1) Gain at 1 kHz.
      2) Maximum output.
      3) Input clipping level.
      4) Frequency response.
      5) Total harmonic distortion.
      6) Signal-to-Noise ratio.
      7) Signal-to-Crosstalk ratio.
   b. Electro/Acoustic Tests:
      1) Uniformity of coverage.
      2) Electronic and acoustic frequency response/one-third octave equalization. Transfer function measurement shall be as close to flat as possible. Measure at ear level. Representative of the Owner will direct final adjustment.
      3) Maximum continuous sound pressure level (in the reverberant field). Drive systems with broadband pink noise. Sustain for at least five minutes with no system damage. Measure for "A" and "C" weightings at ear level on loudspeaker axis. Turn off noise.
      4) Acoustic signal-to-noise ratio referenced to the specified maximum continuous sound pressure level in the reverberant field. Measure for "A" and "C" weightings at ear level on loudspeaker axis with mechanical systems operating. Present comparison with previous measurement.

5) Acoustic gain before feedback. Locate acoustic source (4 inch loudspeaker/pink noise generator) two feet from system microphone. Measure at system microphone position and at most distant listener position at ear level. Present comparison.

7. Video Systems:
   a. Video Monitors:
      1) Apply crosshatch. Verify linearity.
      2) Apply red field. Adjust purity.
      3) Apply SMPTE bars and PLUGE. Adjust to standards.
   b. Video Path Test: Use NTC-7 procedures. Use full field or line signals. Alternately, conduct copper time domain reflectometer test.
8. Fiber System:
   a. Fiber:
      1) Conduct optical loss test.
      2) Conduct optical time domain reflectometer test.
9. Diagnostic Monitoring System:
   a. Demonstrate complete operation.
10. System Overall:
    a. Verify levels.
    b. Provide permanent "wedge" type labels on all controls, as applies, to indicate correct settings after systems performance testing and adjustment procedures have been successfully completed.

C. Loudspeaker Assembly Testing and Adjusting Procedures
   1. Upon completion of the installation of all loudspeakers in an area, perform the following tests and record results. Correct non-conforming conditions, unless the cause is clearly outside the Work of this Section, in which case submit the apparent cause to the Owner.
   2. Loudspeaker Line Impedance: At terminal cabinets at equipment rooms, measure the impedance of each loudspeaker line. Sweep from at least 20 Hz to at least 16 kHz.
   3. Loudspeaker Polarity: Test the acoustic polarity of all loudspeakers using an Acoustic Polarity Tester.
   4. Freedom From Buzzes, Rattles and Objectionable Distortion: Individually apply to each loudspeaker line a slow sine wave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power amplifier output voltage. Listen carefully for buzzes, rattles and objectionable distortion.
   5. Uniformity of Coverage: Apply broadband Pink Noise. Adjust level to approximately 70-80 dBA at measurement locations. Measure in 4 kHz octave band at ear level. Adjust loudspeaker aiming and 70 Volt loudspeaker taps for uniformity of coverage.

D. Equipment Rack and Equipment Testing and Adjusting Procedures
   1. Conduct procedures in fabrication shop. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report with color photographs of each equipment rack, front and back. Request and coordinate verification of submitted test data by the representative of the Owner. Correct all non-conforming conditions prior to shipment to Project Site. Perform at least the following procedures:
   2. Preliminary: Verify:
      a. Grounding of devices and equipment. Integrity of signal and electrical system ground connections.
      b. Proper provision of power to devices and equipment.
      c. Integrity of all insulation, shield terminations and connections.
      d. Integrity of soldered connections. Absence of solder splatter, solder bridges.
      e. Absence of debris of any kind, tools, etc.
      f. Routing and dressing of wire and cable.
      g. All wiring, including polarity and continuity, including conformance with wire designations on running sheets, field and shop drawings.

h. Mechanical integrity of all support provisions.
3. Rig temporary power and grounding: Comply with all applicable Codes, regulations and ordinances.
4. Determine the proper sequence of energizing systems to minimize the risk of damage. Energize. Burn in for at least 120 hours.

E. Telecommunications Cabling Testing
1. Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
2. Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.
3. UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connected.
4. For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568- C.3 and TIA-526-14-A using Method A, Optical Power Meter and Light Source for multimode optical fiber. For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568- C.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source]. Perform verification acceptance tests.
5. Perform testing for each outlet as follows:
   a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA/EIA-568-B.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.
   b. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with TIA-568-C.3. E. Final Verification Tests
   c. Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

3.13 CLEANING

A. Clean each section or area of where the work was conducted after completion to permit immediate use of the area. Remove and discard all refuse, rubbish, and debris.

B. The Contractor shall ensure that all recyclable and environmentally-hazardous waste materials are disposed properly.

C. Make good all existing structures, surfaces, and utilities affected by cutting, coring, mounting, drilling, or other new work.

D. Clean all furnished equipment of dust, dirt, finger prints, smudge, and other material prior to calling for a Substantial Performance of Work Review or Completion of Work Review.

3.14 PROTECTION

A. During the installation phase and up to the date of achieving Substantial Performance of Work, protect finished or unfinished work against damage or loss. In the event of such damage or loss, immediately replace or repair such work or equipment at no cost to the Owner.

3.15 ACCEPTANCE REVIEW, TESTING PROCEDURES AND COMMISSIONING

A. Complete all Work of this Section. Submit Test Report. Submit review copies of Operating and Maintenance Manuals, less reduced set of Record Drawings. Notify the Owner in writing that the Work of this Section is complete and fully complies with the Contract Documents. Request Acceptance Review and Testing by returning Attachment “A” to the Design Consultant. The representative of the Owner will conduct Verification of Submitted Test Data, and otherwise direct testing and adjustment of this Work. These Procedures may be performed at any hour of the day or night as required by the representative of the Owner to comply with the Project Schedule and avoid conflict with these procedures from possible ongoing work of other Separate Contracts and/or the Owner's operations. Provide all specified personnel and equipment at any time without claim for additional cost or time.

B. Personnel: Provide services of the designated supervisor and additional technicians familiar with work of this Section. Provide quantity of technicians as required to comply with Project Schedule.

C. In Addition, Provide:
   1. Set of hand and power tools appropriate for performance of adjustment of and corrections to this Work.
   2. Include spare wire and connectors and specified tooling for application.
   3. Ladders, scaffolding and/or lifts as required to access loudspeakers and other high devices.
   4. Test equipment to include but not limited to:
      a. Dual channel FFT-based audio analyzer
      b. Video test generator with color bars, grayscale, alternating pixel, multi-burst, crosshatch and % windows.
      c. InfoComm Projection Shoot-Out DVD
      d. Digital Video Essential Professional DVD
      e. Category cable tester, cable length, short, open and miswire test.
   5. Complete set of latest stamped, actioned submittals of record for reference.
   6. Complete set of Shop and Project Site Test Reports.
   7. Complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

D. Demonstrate: Complete operation of all systems and equipment, including Portable Equipment.
   1. General
      a. Configure room for each type of event and demonstrate audio-visual system.
      b. Connection of portable equipment. (Laptop, document camera, etc.)
      c. Demonstrate to the Consultant that all functions and equipment for the system work properly when installed as a complete system.
      d. The Contractor shall demonstrate the satisfactory operation of all controls and adjustment circuits of the system.
      e. Demo room scheduling software where applicable.
      f. Room combining and dividing presets.
      g. Demonstrate system startup and shut down procedures.
   2. Audio
      a. Route audio to program speakers.
      b. Route audio to monitor speakers.
      c. Patch each audio tie line into system.
      d. Route audio signal to auxiliary speakers.
      e. Connect microphone to each panel input and route through system.
      f. Demonstrate and document gain structure through the system.
      g. Demonstrate and document with a dual channel FFT-based audio meter the following:
         1) Polarity of each driver in each cabinet.
         2) Crossover point of high, mid and low section of each loudspeaker.
         3) dB SPL levels from 1-4 kHz at various position in the audience area.
         4) dB SPL level of high, mid, low and sub frequency bandwidth at crossover.
      h. Audio routed to ceiling speakers.
      i. Audio Conferencing.

j. Wireless microphones.
k. Demonstrate that the audio system is properly time aligned and equalized.
l. Assistive listening system.
m. Production intercom system.

3. Video
   a. Route source equipment (Blu-ray Player, TV tuner, test generators, etc.) to video displays and projectors.
   b. Set up rooms for each type of event that may take place and demo each.
   c. Recording of a distance learning session.
4. Control
   a. Communication between control system and AV equipment, including feedback if device supports 2-way communication
   b. User interface operation.
   c. Password protection of user interface.
   d. Help desk features.
   e. All programmed presets.
   f. Lighting and window shade control.
5. The Contractor 's personnel and test equipment shall be made available to the Consultant in order that:
   a. Selected tests and measurements previously made by the Contractor can re-run.
   b. Other tests may be made at Consultant's discretion.
   c. Additional tests or measurements may be made due to changes in field conditions.
6. It is estimated that the acceptance tests and demonstrations will require approximately *four hours*, unless construction or installation problems or deviations from the specifications are discovered.

E. Adjust: As directed by the representative of the Owner.

F. Correct: In timely manner, failure to comply with the Contract Documents, as reasonably determined by the representative of the Owner.

G. Acceptance Documentation
   1. Official acceptance of the system covered by this specification will occur when the Design-Builder receives the following written documents:
      a. A letter from the Consultant to the Architect acknowledging Final Acceptance of the system stating compliance with all articles of the specifications.
      b. A letter from the Architect to the Contractor stating that all related work has been completed to his satisfaction. Until these documents are received, the installation is not formally complete. The official date of acceptance shall be the date of the letter from the Architect to the Contractor described above.

3.16 CLOSEOUT

A. Punch List: Perform any and all remedial work, at no claim for additional cost or time. Where required, retest and submit Test Report. Notify Owner of completion of Punch List.

B. Portable Equipment: Furnish all portable equipment and spares to the designated representative of the Owner, along with complete documentation of the materials presented. Where applicable, furnish portable equipment in the original manufacturer's packing.

C. Operating and Maintenance Data: Install framed operating and maintenance instructions. Submit Manuals.

D. Project Record Documents: Submit.

E. Keys: If applicable, replace construction locks with permanent locks. Transmit keys to Owner.

F. Training: Conduct specified training and submit training manuals.

G. Warranty: Submit Warranty dated to run from date of Acceptance of the Work of this Section.

3.17 OWNER'S RIGHT TO USE EQUIPMENT

A. Acceptance of the Work of this Section will be after completion of corrections and adjustments required by the "Punch List" which results from Acceptance Review and Testing of the completed installation. The Owner reserves the right to use equipment, material and services provided as part of the Work of this Section prior to Acceptance without incurring any obligation to Accept any equipment or completed systems until all Punch List work is complete and all systems comply with the Contract Documents; or accept any claim for additional cost or time.

Attachment "A"

NOTICE OF COMPLETION
&
REQUEST FOR FINAL INSPECTION

We hereby give notice that the work associated with the Audio-Visual system, at the project named below, is completed and fully complies with the contract documents issued to the Contractor. The required submittals below have been marked as completed.

- ☐ Programming
- ☐ Test Reports
- ☐ Operation Manual
- ☐ Maintenance Manual
- ☐ Training Manual
- ☐ Training
- ☐ Warranty Certificates
- ☐ Record Drawings

We request commissioning and verification testing be scheduled with the Owner's Representative for final system sign off. Attached is a list of test equipment for review and acceptance.

PROJECT INFORMATION

Project Name:	Project Phase:
Project Address:	

CONTRACTOR INFORMATION

Name:	Company:	
Address:		
Signature:		Date:

Note to Contractor: Provide all test equipment for final inspection as described in the specification.

Please complete and fax or email this form to Veneklasen Associates attention AV Department
Fax (310) 396-3424 Email dyoung@veneklasen.com

END OF SECTION

SECTION 282300
VIDEO SURVEILLANCE

Revised, Addendum #3, 09/22/2017

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Providing materials, equipment, submittals, fabrication, installation, labor, programming, configuration, and testing in conformity with applicable Codes and Authorities Having Jurisdiction for the following:

1. A complete Video Surveillance System as described in the Specifications and as shown in detail on the Drawings.
2. Complete Video Surveillance System is defined as all labor and materials required to complete the Work described herein and on the Drawings including but not limited to: conduit, raceways, cables, cabling, wiring, connectors, riser blocks, patch panels, patch cables, network interfaces, back boxes, IP Network Cameras using PoE, analog cameras using digital video encoders, camera lenses, KVM's (video monitors, keyboards, mice), Network Video Recorders, attached data storage hard drive arrays (SAN/NAS), PoE switches, programming, power supplies, power distribution units (PDU's, plug strips), enclosures, tamper switches, latches and locks, mounts, arms, housings, stands, relay interfaces and equipment rack cabinets or rack shelves.
3. Products, equipment, materials, systems, assemblies, software and accessories as specified herein define the minimum standards. Specifications and Drawings do not show or list every item, accessory, fastener, bracket, sub-assembly and appurtenance to be provided. When an item not shown or listed is clearly necessary for proper installation, operation and functioning of the equipment and systems the Security Contractor shall provide, install, test and certify the item at no increase in Contract price.
4. Provide all software, licensing, hardware, cabling, and programming required for the installation, connection, programming, customization, and functional operation of the new Video Surveillance System equipment.
5. Provide and install system video cameras, camera licenses, and labor to the existing ONSSI Video Surveillance System.
6. Provide installation, testing, adjustment and initial configuration programming for all equipment and systems.
7. Provide configuration programming to import floorplan graphical maps of the project sites and to populate the maps with functional device icons in the Video Surveillance System.
8. Coordinate data network connections, programming, and power requirements with Owner's IT department.
9. Conduit, wire, and cable installations performed under this Section shall comply with all applicable Local Building Codes and National Electrical Code with California Amendments.
10. Security Contractor is responsible for fully implementing the Work described in the Specifications and shown on the Drawings to create a fully functional and completely operational Video Surveillance System.

1.2 RELATED SECTIONS

A. 280500 Common Work Results for Electronic Safety and Security Systems

B. 280800 Commissioning of Electronic Safety and Security Systems

1.3 REFERENCES

A. Published specifications, standards, tests and codes and recommended standards of trade, industry or governmental organizations apply to Work in this Section including:

1. ADA – Title 3 of the Americans with Disabilities Act
2. ASCII – American Standard Code for Information Interchange
3. ASTM – American Society for Testing and Materials
4. CCR – Titles 19 and 24 of the California Code of Regulations
5. EIA – Electronic Industry Association
6. NEMA – National Electrical Manufacturers' Association
7. NFPA – 2010 National Fire Protection Association Standards

8. CEC – 2008 National Electrical Code with 2010 CA Amendments
9. CBC – 2009 International Building Code with 2010 CA Amendments
10. CFC – 2009 International Fire Code with 2010 CA Amendments
11. CMC – 2009 International Mechanical Code with 2010 CA Amendments
12. UL – Underwriters Laboratories, Inc.

B. Electronic devices radiating "RF" energy shall comply with Federal Communication Commission regulations, particularly Part Fifteen, and shall meet Class "B" requirements. Provide FCC certificate numbers indicating that the FCC has approved the products.

1.4 QUALITY ASSURANCE

A. All equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.

B. All items of a given type shall be the products of the same manufacturer.

C. All items shall be of the latest technology; no discontinued models or products are acceptable.

D. No “beta” products will be accepted.

E. Security Contractor shall:
   1. Stock a full complement of parts of the same manufacturer and model as installed per these Specifications.
   2. Offer service during normal working hours as well as emergency service on all equipment installed per these Specifications.
   3. Supply parts and service without delay and at reasonable cost.

F. Security Contractor shall be certified for asbestos work (if applicable to this Project).

G. Security Contractor shall be capable of performing service and maintenance on the specified systems.

H. Security Contractor’s lead technician shall be trained and certified by the Video Surveillance System manufacturer and the wireless camera manufacturer. Certifications shall also be held for all aspects of the installation and testing as noted in sections 3.02 A, 3.05 A, and 3.08 C of this specification.

I. Security Contractor shall possess all required Contractor's licenses.

J. The contractor selected to provide the installation of this system shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein.

K. The contractor shall utilize the authorized manufacturer components and distribution channels in provisioning this Project.

L. Contractor shall have a minimum of five (5) years of recent experience on structured cabling systems of similar type and size.

M. Contractor and design firm shall be in compliance with all federal, state and local statutes regarding qualifications of firms.

N. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.

O. The contractor shall own and maintain the tools and equipment approved by the cabling system manufacturer for successful installation and testing of Category 6 balanced twisted pair distribution systems.

P. The contractor shall have personnel who are adequately trained in the usage of such tools and equipment.

1.5 SUBMITTALS

A. Contractor shall provide the following submittals:
   1. Project Schedule

2. Product Data and Shop Drawings
3. System Programming
4. Operation & Maintenance (O&M) Manual
5. “As-Built” Record Drawings
6. Contractor shall submit a resume of qualification with the Contractor's proposal indicating the following:
    a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each
    b. A list of test equipment proposed for use in verifying the installed integrity of metallic and fiber optic cable systems on this project.

B. Unless otherwise noted or required by the Owner, all submittals shall be supplied in Adobe Acrobat “.pdf” format and/or in native Microsoft Office Word “.doc” or Excel “.xls” format.
    1. All delivery of required project submittals shall be accompanied by dated transmittal listing the contents.

C. Submittals must be complete. All security system submittals shall be in a similar format for ease of review. The Owner and Security Consultant reserve the right to reject any submittals determined to be incomplete. Rejection of submittals for failure to meet these requirements shall not be considered grounds for claims of delay.

D. Submit the following Project Schedule submittal to the Owner and Security Consultant for review and approval prior to commencement of Work:
    1. Proposed construction schedule detailing the timeline for the Project. Obtain Owner approval of finalized construction schedule before the commencement of Work.
    2. Confirm sequence of site work and illustrate how multiple concurrent site projects will overlap. Provide and detail float as contingency. Include Owner activities in the schedule.
    3. When Work is performed in a sensitive area or in areas occupied with ongoing activities, coordinate with the Owner and the affected site’s representative to determine the best time to perform the Work required. Sequencing and scheduling of this type is normal on a Project of this nature and shall not be considered grounds for claims of delay.

E. Submit the following Product Data and Shop Drawings submittals to the Owner and Security Consultant for review and approval prior to commencement of Work:
    1. Manufacturer's name, brand name, exact part number, options, accessories and catalog references for all equipment supplied including cabling. Indicate UL Listings for all system components.
    2. Complete wiring diagrams for all components, including cable types and quantities, routings, floor plans indicating device locations, conduit sizes, point-to-point termination and riser diagrams.
    3. Master Device Legend Table on the shop drawings that identifies the symbols used for all devices including mounting heights, back box requirements, part and model numbers, operating voltages (if applicable), wire and cabling requirements, wire label verbiage, and panel termination points.
    4. Fully dimensioned shop drawings including plan views, elevations and details of all security device installations, equipment rooms and closets, consoles, controllers, racks, enclosures, control panels, and fabricated equipment, showing locations of all major components including mounting details. These Drawings shall be 1/4 inch scale at a minimum.
    5. Bill of Materials.
    6. MSDS for fire stopping materials and sealants.
    7. Written certification letter from each manufacturer affirming that Security Contractor is approved for systems installation and service for all systems in this Section.
    8. Partial or “Typical” Drawings will not be accepted. All shop drawings shall be done in AutoCAD.

F. Submit the following System Programming submittals to the Owner and Security Consultant for review and approval prior to commencement of Work:
    1. Submit for review and approval proposed programming, including device names and text descriptions, frame rates, resolutions, IP addresses, and sequence of operations at least 30 days prior to the actual programming of the system.
    2. Approved device naming conventions shall be reflected on the “As-Built” Record Drawings and on device and cable labeling exactly as programmed into the system.

G. Submit the following Operation & Maintenance (O&M) Manual submittals to the Owner and Security Consultant for review and approval upon completion of Work:
   1. Updated product data and shop drawings submittals reflecting the actual accurate "As-Built" conditions.
   2. Warranty letter with start and end date. Clearly note the date of written notification of acceptance by the Owner.
   3. Troubleshooting checklist information.
   4. Replacement parts and consumables ordering information, including the contact information for local sources.
   5. Warranty service and maintenance contact information: including names, address, phone number and website address. Provide specific instructions or forms as required to initiate a trouble ticket or work order request.
   6. Training program, including name and qualifications of trainer(s), schedule of training, and curriculum. O&M's shall be provided as the written training materials and shall be turned over to the attendees upon completion of training.

H. Submit the following "As-Built" Record Drawings submittals to the Owner and Security Consultant upon completion of Work:
   1. Maintain a complete set of "As-Built" Record Drawings updated with mark-ups inserted as the Work is performed. As Work is installed carefully mark on "As-Built" Record Drawings in colored pencil the correct location of all Work including depth of underground runs and concealed Work with their dimensions from clearly identified points on permanent buildings, fixtures, walls, or walks. Wiring diagrams, risers and details shall be included and updated.
   2. Upon completion of the Project transfer hand-drawn information to CAD Drawings. Copy updated CAD Drawings onto compact disc in ".dwg" and Adobe Acrobat ".pdf" formats and submit to the Owner and Security Consultant. No hand-drawn "As-Built" Record Drawings will be accepted.
   3. "As-Built" Record Drawings shall be provided in three (3) full-size hardcopy plotted sets as well as on compact disc to the Owner. One (1) additional complete full-size hardcopy plotted set shall remain on the Project site at the primary security equipment location at the District Office.

1.6 SUBSTITUTIONS

A. All equipment, products and systems shall conform to the Specifications and Drawings. No substitute equipment, products or systems may be used unless previously accepted in writing by the Owner and Security Consultant.

B. Substitution requests must be submitted in writing for review and approval by the Owner and Security Consultant. Requests must clearly show a line by line comparison of the relevant product technical specifications to demonstrate that the proposed substitution meets or exceeds the technical specifications of the specified product. The Owner and Security Consultant reserve the right to accept or reject substitution requests.

C. Manufacturers listed as acceptable are normally engaged in the type of Work specified. The listing of equipment and product part numbers or particular types of systems by specific manufacturers is to establish a minimum standard for the performance, quality, and parameters of the equipment, products and systems specified. The Owner and Security Consultant must approve all substitutions in writing prior to any substitute equipment, products or systems being incorporated into this Project.

D. Any substitute equipment, products or systems incorporated into this Project without prior written approval from the Owner and Security Consultant will be considered defective and may be rejected at the discretion of the Owner. Rejected items shall be promptly removed from the Project and replaced with the specified materials and equipment by the Security Contractor at no increase in Contract price and shall not be considered grounds for claims of delay.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Ship equipment in original manufacturer packaging to prevent damage or entry of foreign matter. All handling shall be in accordance with manufacturer recommendations. Provide protective covering of installed items during construction. All equipment is to be protected from dents, bumps, and scratching.

B. Replace, at no increase in Contract price, all equipment, products, or systems damaged during shipping, handling, distribution, storage, or installation or during subsequent construction.

C. Products delivered to the Project site and stored, whether on the Project site or in an off-site location previously approved in writing by the Owner, shall be protected from weather, dust, dirt, and foreign matter. Storage shall be locked and secured at all times when not under direct supervision and use.

1.8 PROJECT WARRANTY

A. Security Contractor and system and product manufacturers guarantee installation, equipment, computer hardware, software, software support, licenses, and all parts and labor for five (5) years from date of written notification of acceptance by the Owner, as the base bid. Additional Alternates are described in the Add Alt specifications. Contractor shall price all Add Alts as separate line items for consideration.

1. Contractor shall have cameras readily available for proper swap outs during the 5 years of warranty, if needed.

B. Project warranty is in addition to and supplements any existing or future Service Level Agreement (SLA) and shall not be construed to diminish existing or future agreements in any way.

C. Security Contractor shall provide, upon notification of a problem, a field service technician to correct the problem within twenty-four hours of notification or as otherwise agreed to in an existing or future Service Level Agreement (SLA).

D. At sixty days prior to expiration of warranty Security Contractor shall perform complete system functionality testing as described in PART 3 TESTS AND REPORTS of this Section.

1. Warranty shall not expire and shall remain in full force and effect until all identified problems and deficiencies are corrected and system is fully functional and completely operational.

PART 2 – PRODUCTS

2.1 NETWORK CAMERAS

A. Network Cameras will transmit images over the Local Area Network (LAN). Contractor to provide an excel sheet, listing cameras and their locations to the Owner to provide the IP addresses/host names as part of the base bid.

B. All network cameras will be IP-based cameras. No analog cameras will be used/approved/accepted for the purpose of this scope of work.

C. All network cameras will terminate in their designated IDF rooms or closets. The location of these rooms/closets shall be per the drawings and field verified. If discrepancies occur, contractor shall coordinate with IT.

D. All cameras shall be vandal resistant with vandal/tamper proof screws. Contractor shall provide (2) of each type of driver bit needed for the special vandal/tamper proof screws.

E. All cameras that require wide dynamic range (WDR), per specifications below, shall meet or exceed a range of 90 dB.

F. All shall be a minimum of IP66 rated water-resistant/dust-tight and IK10 rated vandal-resistant.

G. Integrated on-board analytics to trigger alarms based on user-defined rules for monitoring a doorway for access beyond approved hours.

H. All cameras shall have a minimum operating temperature range from -40° F to 122° F.

I. All cameras must have drivers compatible with ONSSI VMS Software, beyond onVif integration.

J. Interior Mini Dome Cameras:

1. Will be Day/Night with WDR per manufacturer specs.
2. Cameras will have built in support for Power over Ethernet.
3. Will be equipped with Varifocal lenses

4. H.264 compression or better shall be used. If deviating from H.264, written approval shall be obtained from SAC-IT.
5. Exmor CMOS sensor with integrated image stabilizer to minimize vibration effects on image.
6. Built in IR illuminators. Minimum illumination of 0 lx in B/W and 0.1 lx in Color.
7. These will be flush, surface, wall and corner mounted as indicated in the device schedule and via field verifications at the responsibility of the contractor.
8. These cameras will be located in the following areas:
    a. Classrooms/ Office areas
    b. Interior classroom corridors
    c. Perimeter areas.
9. Part number:
    a. Sony SNC-EM632R
    b. Or approved equivalent

K. Exterior Mini Dome Cameras:

1. Will be Day/Night with WDR per manufacturer specs.
2. Cameras will have built in support for Power over Ethernet.
3. Will be equipped with Varifocal lenses
4. H.264 compression or better shall be used. If deviating from H.264, written approval shall be obtained from SAC-IT.
5. Exmor CMOS sensor with integrated image stabilizer to minimize vibration effects on image.
6. Built in IR illuminators. Minimum illumination of 0 lx in B/W and 0.1 lx in Color.
7. These will be flush, surface, wall and corner mounted as indicated in the device schedule and via field verifications at the responsibility of the contractor.
8. These cameras will be located in the following areas:
    a. Throughout exterior corridors.
    b. In critical areas.
    c. Exterior of building and campus entrances.
    d. Other areas as designated.
9. Part number:
    a. Sony SNC-EM632R
    b. Or approved equivalent

L. Exterior Fixed Megapixel Camera

1. Will be Day/Night with WDR per manufacturer specs.
2. Each camera assembly is 3 to 5 MP, clear dome, auto-focus/remote-focus, auto iris, with lowlight capability.
3. Cameras will have built in support for Power over Ethernet.
4. Will be equipped with Varifocal lenses
5. H.264 compression or better shall be used. If deviating from H.264, written approval shall be obtained from SAC-IT.
6. Outdoor (IP66) rated.
7. These will be flush, surface, pole, wall and corner mounted as indicated in the device schedule.
8. Built in IR illuminators.
9. These cameras will be located in the areas designated on the floor plans.
10. Approved Manufacturers:
    a. Sony SNC-CH280
    b. Or approved equivalent

M. Interior Fixed Dome Megapixel Camera

1. Will be Day/Night with WDR per manufacturer specs.
2. Each camera assembly is 3 to 5 MP, clear dome, auto-focus/remote-focus, auto iris, with lowlight capability.
3. Cameras will have built in support for Power over Ethernet.
4. Will be equipped with Varifocal lenses
5. H.264 compression or better shall be used. If deviating from H.264, written approval shall be obtained from SAC-IT.
6. Outdoor (IP66) rated.
7. These will be flush, surface, pole, wall and corner mounted as indicated in the device schedule.
8. Built in IR illuminators.

9. These cameras will be located in the areas designated on the floor plans.
10. Approved Manufacturers:
    a. Sony SNC-CH280
    b. Or approved equivalent

N. Interior Fixed Bullet Megapixel Camera
1. Will be Day/Night with WDR per manufacturer specs.
2. Each camera assembly is 3 to 5 MP, clear dome, auto-focus/remote-focus, auto iris, with lowlight capability.
3. Cameras will have built in support for Power over Ethernet.
4. Will be equipped with Varifocal lenses
5. H.264 compression or better shall be used. If deviating from H.264, written approval shall be obtained from SAC-IT.
6. Outdoor (IP66) rated.
7. These will be flush, surface, pole, wall and corner mounted as indicated in the device schedule.
8. Built in IR illuminators.
9. These cameras will be located in the areas designated on the floor plans.
10. Approved Manufacturers:
    a. Sony SNC-CH280
    b. Or approved equivalent

O. Exterior PTZ Camera
1. Will be Day/Night with WDR per manufacturer specs.
2. Each camera assembly is 1080P/ 60FPS, clear dome, auto-focus/remote-focus, auto iris, with lowlight capability.
3. Cameras will have built in support for Power over Ethernet (HPoE).
4. 30X OPTICAL ZOOM, 700°/sec pan speed
5. H.264 compression or better shall be used. If deviating from H.264, written approval shall be obtained from SAC-IT.
6. Outdoor (IP66 & IK10) rated.
7. These will be flush, surface, pole, wall and corner mounted as indicated in the device schedule.
8. These cameras will be located in the areas designated on the floor plans.
9. Approved Manufacturers:
    a. Sony SNCWR632C
    b. Or approved equivalent

2.2 VIDEO SURVEILLANCE SYSTEM

A. Video Surveillance System Server Software and Computing Hardware

1. The existing Network Video Management software is from ONSSI, Ocularis Ultimate Edition.

2. All new cameras to being installed shall be programmed into the existing system.

3. Contractor shall provide additional channel licenses for the new cameras.

2.3 NETWORK VIDEO RECORDERS (NVR)

A. Owner will, configure, and install network-based video recorders compatible with the ONSSI Ocularis Ultimate Edition Software.

B. Owner will provide and install the following devices for the Science building IP Cameras:

1.	719061-B21	(1) HP DL380 Gen9 12LFF CTO Server
2.	719048-L21 3	(1) HP DL380 Gen9 E5-2650v3 FIO Kit
3.	719048-B21	(1) HP DL380 Gen9 E5-2650v3 Kit
4.	726718-B21	(4) HP 8GB 1Rx4 PC4-2133P-R Kit
5.	724864-B21	(1) HP DL380 Gen9 2SFF Bay Kit
6.	793703-B21	(12) HP 8TB 12G SAS 7.2K 3.5in 512e SC HDD
7.	764925-B21	(2) HP 240GB 6G SATA VE 2.5in SC EV M1 SSD
8.	761874-B21	(1) HP Smart Array P840/4G FIO Controller

9. 783007-B21 (1) HP DL380 Gen9 P840/440 SAS Cable Kit
10. 785991-B21 (1) HP DL380 Gen9 12LFF SAS Cable Kit
11. 726903-B21 (1) HP Smart Array P841/4GB FBWC 12Gb 4-ports Ext SAS Controller
12. 733662-B21 (1) HP 2U LFF Easy Install Rail Kit
13. 720478-B21 (1) HP 500W FS Plat Ht Plg Pwr Supply Kit
14. BD505A (1) HP iLO Adv incl 3yr Tech Support and Updates 1-Svr Lic
15. H7J33A5 (1) HP 5yr Foundation Care NBD w DMR Service
16. H7J33A5:R2M (1) iLO Advanced Non Blade - 3yr SW Supp
17. H7J33A5:TT3 (1) HP ProLiant DL380 Gen9 HW Supp

2.4 PATCH PANELS AND JUMPER CABLING

A. Patch Panels will be provided by the contractor where necessary.

B. Contractor to provide the Category 6A patch cords to be connected from the patch panel to the Network Switch. Network switch will be provided by SAC.

2.5 WIRE AND CABLE

A. Wire and Cable Specifications

1. Security Contractor shall follow the manufacturers' recommendation for cabling or the minimum requirements of the Specifications and Drawings, whichever provides for the most stringent requirements.
2. Wire and cable sizes, number of conductors, shielding, or other data listed in this Specification or shown on Drawings are a guide to the correct product required to achieve a working system and represent the minimum acceptable equipment.
3. Cables are to be shielded as necessary to preclude any outside noise or interference from entering the cable and degrading system performance. All cables shall be U.L. Listed, and appropriate for the application.
4. Use proper grounding practices to eliminate shorts, ground faults, ground loops, RF interference, voltage fluctuations, foreign voltages and open circuits.
5. Coordinate with the Owner’s IT department for data network connections, terminations, dressing, routing, patch panels, and jumpers.
6. Cables run underground, under slab, or in slab shall be installed in conduit and environmentally rated for such application.
7. Cables above hard ceiling or inaccessible areas shall be installed in conduit. Stub up conduits from within walls into accessible spaces.
8. All cables run in environmental air handling spaces shall be plenum rated. Provide proper J-hooks or cable trays for cables not run in conduit.
9. Mixing of security low voltage cables with data network or telecomm cables or the cabling of other systems will not be permitted.
10. Security low voltage cables and Ethernet Category 6 cables shall be provided in colors as selected by the Owner.
11. Cables shall be routed along walls and at right angles. Cabling shall not be draped loosely or resting on pipes, HVAC ductwork and equipment, or suspended tile ceilings. Avoid routing cabling bundles across or within 18” of lighting fixture ballasts.
12. When installing cable do not pull or stretch cabling beyond the manufacturer’s maximum tensile strength.
13. Do not cinch tight cable bundles (especially Ethernet cables) with tie wraps. Bundle cables together using Velcro straps.
14. Cable shall be run in unbroken homerun lengths of 300 feet or less. No cable runs shall be over 300’will be accepted. Cable splices are not allowed.
15. Wiring shall be grouped and harnessed to facilitate access to all equipment, as well as maintenance and replacement of equipment.
16. Cabling shall be sized and installed according to California Electric Code requirements.
17. Cabling shall be West Penn, Belden, Connect-Air, or approved equal.

B. Communication/Network Cabling

1. All network cable used shall be purple in color.
2. Twisted-pair network cable shall meet or exceed Category 6A requirements in ANSI/TIA-568-C.2

3. Any fiber optic cable shall meet or exceed requirements in ANSI/TIA-568-C.3 as applicable per the approved type of fiber.
    a. If fiber cables are required due to distance limitations, this shall be identified, specified, priced, and submitted to SAC-IT for approval with your original bid documents.

C. Quality Assurance
1. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner representative.
2. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.
3. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
4. Material and work specified herein shall comply with the applicable requirements of:
    a. ANSI/TIA/EIA – 568-B Commercial Building Telecommunications Cabling Standard, 2000-2004
    b. TIA – 569-B Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
    c. ANSI/TIA/EIA – 606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2002
    d. ANSI-J-STD – 607-A Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
    e. NFPA 70 – National Electric Code, 2005
    f. BICSI – Telecommunications Distribution Methods Manual, 10th Edition, 2003
    g. NEMA – VE-1 – Metal Cable Tray Systems, 2002
    h. NEMA – VE-2 – Metal Cable Tray Installation Guidelines, 2001

PART 3 – EXECUTION

3.1 REQUIREMENTS

A. Video Surveillance System shall be fully functional and completely operational.

B. All wall, floor, and ceiling penetrations, regardless of the fire rating of the partition, must be properly sleeved with EZ-Path or conduit penetration assembly and properly sealed using approved fire stopping materials and sealants.
1. Exterior penetrations shall be properly sealed using approved weather-proof fire stopping materials and sealants.

C. Provide seismic restraint for all equipment, including equipment racks and consoles.

D. Security equipment, devices, brackets, mounting arms or pendants, junction boxes, cabinets, and enclosures shall be installed utilizing stainless steel tamper-resistant fasteners and mounting hardware.
1. Tamper-resistant fasteners shall be pin Torx.
2. Provide two (2) driver bits and hand tools to the Owner's representative for each type and size of pin Torx security fastener provided.

E. The District ITS Department shall configure all cameras with the appropriate TCP/IP address and District configuration prior to Contractor installation. ***ADD-3***

3.2 CABLE

A. General (applicable to all cable types Cable shall be installed in strict compliance with the manufacturer's recommendations.

B. Maintain separation from other conductors (power, fire alarm, etc.) per NEC requirements and TIA/EIA standards.

C. The bending radius and pull strength requirements of all cable as detailed in the TIA/EIA standards and the manufacturer's installation recommendations shall be strictly observed during handling and installation.
   1. Pull cables simultaneously where more than one cable is being installed in the same raceway.
   2. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation (Polywater, or approved equal).
   3. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cable or raceway.

D. Cable jackets shall not be twisted during installation. Cables showing evidence of twisting shall be replaced at no additional cost to the Owner, regardless of the outcome of cable testing.

E. Cable shall be installed in a continuous (non-spliced) manner unless otherwise indicated.

F. Cable installed in conduit and/or ducts:
   1. Fill ratios shall not exceed NEC requirements.
   2. Cable shall not be pulled into conduit/ducts until the conduit/duct ends have been prepared for cable installation (i.e. reamed to eliminate sharp edges and insulated throat bushings installed). Cables pulled into conduit/ducts prior to conduit/duct end preparation shall be replaced at no additional cost to the Owner.
   3. Reinstate pull-wires in conduits and ducts after use to facilitate future addition of cables.
   4. Standard in-wall communication outlets shall be installed in a 4" x 4" x 2.4" device box with 1" conduit stubbed to above ceiling.

G. Cable installed in cable tray:
   1. Cable shall not be attached to the cable tray (i.e. cable shall be left "loose") with the exception of cable installed in cable tray (cable runway) within Telecom Rooms (see "Cable in Telecom Rooms" below).
   2. For performance reasons, station cable in tray shall not be combed.
   3. Cable shall be laid in tray in such a way as to present a neat and professional appearance

H. Cable NOT installed in conduit/ducts or cable tray:
   1. Cables shall be strapped or fastened for support. Staples and plastic cable ties are not acceptable.
      a. Straps and fasteners shall not be over-tightened. Cables showing evidence of over-tightening shall be replaced at no additional cost to the Owner, regardless of the outcome of cable testing.
      b. Straps, fasteners, and tie-wraps installed in plenum spaces shall be plenum rated.
      c. Reusable Velcro hook and loop style cable straps/fasteners shall be used within Telecom Rooms. The use of plastic tie wraps is not acceptable within Telecom Rooms (see "Cable in Telecom Rooms" below).
      d. Cables shall be bundled by application (horizontal or backbone) and by cable type (Cat 3, Cat 6 UTP, MM Fiber, SM Fiber, etc.). Cable applications and types shall not be intermixed within a bundle.
   2. Cables in suspended cable runs shall be supported at varying intervals. Cable spans shall be limited to 5 feet or less, and the length of spans shall vary along the cable path (i.e. a given span should not be exactly the same length as the span preceding or following it – "exact" spans can degrade cable performance).
   3. Cable installed on exposed surfaces or structural members shall be installed parallel and perpendicular to the surfaces. Surface contours shall be followed wherever possible. Cables shall be attached to surfaces at intervals not to exceed 3 feet.
   4. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors) is not acceptable.

I. Cable installed in Telecom Rooms
   1. Cable on backboards:
      a. Lay and dress all cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.

b. Cable shall be routed as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.
c. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Secure all similarly routed and similar cables together and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

J. Cable terminating on patch panels located on racks.
1. Route cables in Telecom Rooms to patch panels on racks by routing across cable runway to top of rack and then down vertical cable management sections to patch panel.

K. Cable Slack:
1. Provide cable slack (service loops)
2. Provide slack length as follows:
a. At the device box: Provide a minimum of 6 feet.

3.3 FIELD LABELING REQUIREMENTS

A. Labels shall be printed on self-adhesive labels.
1. Hand written labels or writing directly on equipment or cabling is not acceptable.

B. Label all networked equipment with the host name as shown on the drawings the drawings.
1. Security device addresses and text descriptions shall be reflected on the labeling and on the "As-Built" Record Drawings exactly as programmed into the systems in accordance with the approved System Programming submittal.
2. Cameras shall not be labled.

C. Cables shall be individually labeled at origin and termination at both ends as close as possible to their termination point, referenced to a master cable legend schedule as shown on "As-Built" Record Drawings.

D. Cabling homerun routing and Security Terminal Cabinets (STC) locations, if any, shall be noted on "As-Built" Record Drawings.

E. Cable labels shall be affixed to individual cables in the "flagged" position.
1. This means that the associated approved device address label is printed twice on a self-adhesive label with sufficient space between the duplicate text to wrap around the cable.
2. The printed label is then wrapped around the individual cable and affixed to itself.
3. This results in a "flagged" position label so that the complete device address label can be read from either side of the label.

3.4 TRAINING

A. Training shall be by engineers or technicians highly skilled in the systems installed and factory trained and certified by the manufacturer as qualified to train in the particular systems.

B. Training focus:
1. Main focus shall be on "help" features of the system. SAC-IT anticipates this will be the most used feature and users need to be trained to allow proper level of comfort and system familiarity.

C. Provide eight (8) hours of scheduled training for the equipment provided under this Section, including programming, operation, service, and maintenance.

D. Training shall be conducted at dates and times as directed by the Owner.
1. Provide proposed training schedule and syllabus for review and approval prior to beginning any training.
a. Coordinate with SAC-IT while composing proposed schedule.
2. Training will be provided over multiple sessions at multiple locations as needed to accommodate the dates and times and attendees as directed by the Owner.

3. The initial default distribution of training sessions shall be conducted as ten (10) 2-hour sessions subject to approval by the Owner.

E. Training sessions shall be shall be provided in a “train the trainer” model as well as in sessions for general users.

F. Documentation of completion of training shall be delivered to and verified by the Owner prior to release of retainage.

G. Provide hardcopy and softcopy training materials to turnover to all attendees for all training sessions. Training material handouts should include, at a minimum, Operation & Maintenance (O&M) Manual which includes the final Product Data and “As-Built” Record Drawings as described in PART 1 SUBMITTALS.

3.5 PROGRAMMING

A. All system programming shall be by the SAC-IT department.

3.6 CATEGORY 6A CABLE TESTING

A. Ethernet Category 6A Cabling shall be field tested after installation.

B. Documentation shall be submitted for review and approval by the Owner and Security Consultant to demonstrate that all cabling meets or exceeds ANSI/TIA/EIA 568-B.2-1 Commercial Building Telecommunications Cabling Standards and Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.

C. Deficiencies shall be corrected prior to utilizing the installed cabling as a component of the Video Surveillance System.

3.7 TESTS AND REPORTS

A. System testing and reporting will occur in two phases.

B. Security Contractor shall perform System Functionality Testing and correct all deficiencies prior to performing the Commissioning Testing with the involvement of the District Representative, SAC-IT, and Security Consultant.

C. Perform System Functionality Testing using manufacturer-certified personnel who have attended a manufacturer's training school for installation and testing of the systems. Perform testing with the test instruments and methodology as required by the manufacturer; testing by means other than the manufacturer's procedures will not be acceptable unless agreed to by the Owner and Security Consultant and manufacturer.

D. Security Contractor shall perform System Functionality Testing and document these tests for review and approval by the Owner and Security Consultant prior to the Commissioning Testing.

E. If testing will require monitors, mouse, and keyboards, contractor is to provide their own equipment at no extra cost to the client. Monitors, mouse, and keyboards are not provided by SAC-IT at any of the IDF rooms or IDF closet locations.

F. At a minimum, perform System Functionality Testing to demonstrate and document:
   1. Cameras
      a. The camera video feed displays on client workstations without flickering due to excessive latency greater than half of a second.
      b. The camera video feed displays on client workstations without pausing or freezing.
      c. The camera auto-focuses to display clear image acceptable by SAC-IT.
      d. The day/night interior and exterior cameras adjust properly between day and night lighting conditions.
      e. The Wide Dynamic Range and auto-backlight compensation cameras adjust properly to challenging lighting conditions to produce clear, bright, and focused images.
      f. The camera produces a stable picture with no roll, flutter or ghosting.
      g. The camera resumes operation and produces clear, bright, and focused images when PoE power or network connectivity is restored from a failure.

G. Upon completion of the System Functionality Testing Security Contractor shall submit written reports including but not limited to the following information:
   1. Certification that all devices and equipment meet or exceed the requirements of the System Functionality Testing.
   2. Certification that all equipment is properly installed, programmed, fully functional and completely operational, and conforms to Specifications and Drawings.
   3. Complete Bill of Materials of all equipment installed including quantity, make and model as well as serial numbers, MAC addresses, and IP addresses/host names of major components.
   4. Technician's field test reports of all cameras, cables, devices, and equipment.
   5. Test technician's name, company and date(s) of test.
   6. Exceptions shall be clearly noted in a Punch List.

H. Following review and acceptance of the System Functionality Testing report by the Owner and Security Consultant, the Security Contractor shall perform Commissioning Testing of all security system equipment and software in the presence of the Owner and Security Consultant.

I. Commissioning Testing shall include performance testing and functionality testing to demonstrate to the Owner that each system software and hardware component functions as required by the Specifications and Drawings. The Security Contractor shall be responsible for all additional costs to the Owner and Security Consultant if retesting is required.

J. At a minimum, perform Commissioning Testing in the presence of the Owner and Security Consultant to demonstrate and document:
   1. Each camera, cable, data network switch, NVR, server, and client computer workstation functions as an integrated element of the Video Surveillance System.
   2. Fully functional and completely operational condition of the cameras, client computer workstations, NVR's, and Video Surveillance System server.
   3. An abnormal condition of any signaling or communication circuit, device malfunction, or image loss required to be electrically supervised will result in activating the specified trouble or tamper alarm notification signal.
   4. All Video Surveillance System software functions properly in accordance with manufacturer's written specifications and all equipment is fully programmed.

END OF SECTION

SECTION 312000
EARTH MOVING

Revised, Addendum #3, 09/22/2017
Revised, Addendum #2, 09/01/2017

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses and exterior plants.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for slabs-on-grade.
   4. Base course for concrete, walks and pavements.
   5. Base course for asphalt paving.
   6. Excavating and backfilling for utility trenches.

1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC), latest edition and supplements for rock materials. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 REFERENCES

A. This specification section has been prepared using the project soils report by Terracon Consultants dated June 27, 2016 as a reference.

1.4 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Classified Excavation: Removal and disposal of materials not defined as rock

F. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.

K. Unclassified Excavation: Removal and disposal of materials encountered regardless of nature of materials, including rock.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 PROJECT CONDITIONS

A. Examine site, Drawings, records of existing utilities and construction, record of test borings, and subsurface exploration report available from Owner. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

1.6 PROTECTION

A. Soils Consultant: A geotechnical consultant shall advise on Construction techniques involved in work, including design, checking and approving of temporary bracing, sheeting, shoring, underpinning and other items pertinent to work, and encountered during prosecution of work. Consultant shall be primarily concerned with construction methods, which will prevent settlement or damage to surrounding structures, sidewalks, embankments, utilities and roads on Owner's property and adjoining properties.

B. Existing Utilities:

1. Maintain existing utilities that are to remain in service. Before excavating over or adjacent to existing utilities, notify utility Owner to ensure protective work will be coordinated and performed in accordance with utility Owner's requirements. If existing service lines, utilities and utility structures, which are to remain in service, are uncovered or encountered during these operations, safeguard and protect from damage.
2. Within limits of excavation, remove existing piping, subsoil drainage systems, conduit, manholes and relocated items, which are to be abandoned. Plug open ends of utilities to remain with concrete.
3. Re-route existing subsoil drains which obstruct work around new constructions, or incorporate them into new drainage systems.
4. Consult Architect immediately for directions, should uncharted or incorrectly charted piping or other utilities be encountered during excavation. Cooperate with Owner and public and private utility companies in keeping their respective services, utilities and facilities in operation. If damaged, repair utilities to satisfaction of Architect and utility Owner.

C. Existing Facilities: Protect and maintain in satisfactory manner, existing pavements, curbs, gutters, structures, conduits, fences, walls and other facilities to remain above and below grade. Restore facilities damaged by construction operations.

D. Pumping and Draining: Excavate areas in such manner as to afford adequate drainage. Control grading in vicinity of excavated areas so ground surface will slope to prevent water running into excavated areas. Until work is completed, remove water from areas of construction that may interfere with proper performance of work or that may result in damage to the soil sub-grade and provide sumps, pumps, well points, electric power and attendance required for this purpose on a 24 hour basis if necessary. Protect construction from water during construction, including prevention of erosion of completed work during construction and until permanent drainage and erosion controls are operational. Repair adjoining properties, facilities and streets damaged due to improper protection.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Sand, gravel, friable earth, or non-expansive clays, subject to Testing Laboratory's approval. Fill and backfill material shall be free of organic material, slag, cinders, expansive soils, trash or rubble and stones having maximum dimension greater than six inches.

C. Unsatisfactory Soils: Expansive and other soils as defined in the project's geotechnical investigation report.

1. Unsatisfactory soils also include satisfactory soils not maintained within two percent of optimum moisture content at time of compaction.

D. Base Course: Aggregate material must be clean and consist of any combination of the following: broken stone, crushed gravel, natural rough-surfaced gravel, and sand. Gradation and aggregate quality characteristics shall conform to the provisions in Caltrans Standard Specification Section 26, Class II Aggregate Base. ~~SSPWC section 200-2.2, Crushed Aggregate Base or SSPWC section 200-2.4 Crushed Miscellaneous Base~~. ***ADD-2 ADD-3***

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a one and one-half inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded clean, crushed sand; ASTM D 2940; except with 100 percent passing a 3/8-inch sieve and not more than eight percent passing a No. 200 sieve.

G. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a one and one-half inch sieve and zero to five percent passing a No. 8 sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, six inches wide and four mils thick, continuously inscribed with a description of the utility. Color coding shall be according to the American Public Works Association (APWA) standards:

1. Blue – Potable water and fire suppression lines.
2. Green – Sanitary sewer and storm drain lines
3. Orange – Communication, alarm or signal lines
4. Purple – Reclaimed water, irrigation, and slurry lines
5. Red – Electrical power lines, cables, conduit and lighting lines
6. Yellow – Gas, oil, hydronic chilled water, steam, petroleum, or gaseous material lines

PART 3 EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing" or "Demolition".

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing" or "Demolition," during earthwork operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide six-inch clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches six inches deeper than elevation required in rock or other unyielding bearing material, four inches deeper elsewhere, to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section Cast-in-Place Concrete.

D. Provide four-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of four inches of concrete before backfilling or placing roadway base.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than one inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, minimum 6 inches above top of pipe, minimum 12 inches below finished grade, except six inches below subgrade under pavements and slabs.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use engineered fill.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within two percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by two percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material to 95 percent.
2. Under walkways, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill soil material to 90 percent.
3. Under lawn or unpaved areas, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill soil material to 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material to 85 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus one inch.
   2. Walks: Plus or minus one inch.
   3. Pavements: Plus or minus one-half inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of one-half inch when tested with a 10-foot straightedge.

3.14 BASE COURSES

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:
   1. Shape base course to required crown elevations and cross-slope grades.
   2. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.15 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Place drainage course that exceeds six inches in compacted thickness in layers of equal thickness, with no compacted layer more than six inches thick or less than three inches thick.
   2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 321216
ASPHALT PAVING

Revised, Addendum #3, 09/22/17
Revised, Addendum #2, 09/01/17

GENERAL

SUMMARY

This Section includes hot-mix asphalt paving, patching and paving overlay.

SUBMITTALS

Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

Material certificates.

Log of placement of asphalt, including dates, times, temperature readings and other pertinent information.

QUALITY ASSURANCE

Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC) and the California Department of Transportation (Caltrans), latest editions and supplements for asphalt paving work. These Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

PROJECT CONDITIONS

Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

Tack Coat: Minimum surface temperature of 60 degrees Fahrenheit.
Asphalt Base Course: Minimum surface temperature of 40 degrees Fahrenheit and rising at time of placement.
Asphalt Surface Course: Minimum surface temperature of 60 degrees Fahrenheit at time of placement.

Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees Fahrenheit for oil-based materials, 50 degrees Fahrenheit for water-based materials, and not exceeding 95 degrees Fahrenheit.

PRODUCTS

AGGREGATES

~~Coarse Aggregate: Crushed rock conforming to SSPWC 400-4.2.3.~~

~~Fine Aggregate: Sand, rock dust, mineral filler, or a blend of these materials conforming to SSPWC 400-4.2.4. Mineral filler, if required, shall conform to SSPWC section 203-6.2.3~~.

Aggregate must be clean and consist of any combination of the following: broken stone, crushed gravel, natural rough-surfaced gravel, and sand. Gradation and aggregate quality characteristics shall conform to the provisions in Caltrans Standard Specification Section 26, Class II Aggregate Base. ***ADD-2 ADD-3***

ASPHALT MATERIALS

Asphalt Binder: Paving asphalt, viscosity grade PG 64-10 conforming to Section 92 of the Caltrans Standard Specifications.

Tack Coat: PG 64-10 conforming to Section 92 of the Caltrans Standard Specifications.

Mixes: Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mix III-C3 PG 64-10 designed in conformance with SSPWC Section 400-4.

AUXILIARY MATERIALS

Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.

Color: White, Yellow and Blue per Federal Standard 595 Color 15090).

Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized.

Dowels: Galvanized steel, three-fourths-inch diameter, 24-inch minimum length.

EXECUTION

COLD MILLING

Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

Mill to a depth of not less than one and one-half inches.

PATCHING

Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gallons/square yard.

Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

SURFACE PREPARATION

Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gallons/square yard.

Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

HOT-MIX ASPHALT PLACING

Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

Spread mix at minimum temperature of 250 degrees Fahrenheit.
Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

COMPACTION

General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

Complete compaction before mix temperature cools to 185 degrees Fahrenheit.

Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

INSTALLATION TOLERANCES

Thickness: Compact each course to produce the thickness indicated within the following tolerances:

Base Course: Plus or minus one-half inch.
Surface Course: Plus one-fourth inch (no minus).

Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

Base Course: One-fourth inch.
Surface Course: One-eighth inch.
Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is one-fourth inch.

PAVEMENT MARKING

Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

Allow paving to age for 30 days before starting pavement marking.

Sweep and clean surface to eliminate loose material and dust.

Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

WHEEL STOPS

Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel one inch beneath top of wheel stop.

FIELD QUALITY CONTROL

Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

DISPOSAL

Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in a landfill by the Environmental Protection Agency (EPA).

END OF SECTION

SECTION 321313
CONCRETE PAVING

Revised, Addendum #3, 09/22/17
Revised, Addendum #2, 09/01/17

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Driveways and roadways.
   2. Parking lots.
   3. Curbs and gutters.
   4. Walkways.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including admixtures.

B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

C. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction (SSWPC), latest edition and supplements.

D. The Contractor shall have one copy of the Standard Specifications at the job site.

E. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.

PART 2 PRODUCTS

2.1 STEEL REINFORCEMENT

A. ~~Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.~~ ***ADD-2***

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement: ASTM C 150, Type II, low alkali. Supplement with the following:

a. Pozzolan: ASTM C618, Class F or N Fly Ash, 100 pounds maximum per cubic yard, containing one percent or less carbon. Fly ash shall not be used in excess of 15 percent by weight of total cement quantity.

B. Combined Aggregates: Gradation "C" conforming to SSPWC Section 201-1.3.2.

C. Water: ASTM C 94/C 94M.

2.3 CURING MATERIALS

A. Liquid Curing Compound: ASTM C309, fugitive dye dissipating type, complying with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254.

B. Moisture-Retaining Cover (Curing Sheet): ASTM C 171, non-staining polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

2.4 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.

1. Color: As indicated.

2.5 WHEEL STOPS

A. Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized.

1. Dowels: ~~Galvanized steel, three-fourths-inch diameter, 24-inch minimum length~~ Refer to drawings. ***ADD-3***

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:

1. Compressive Strength (28 Days): 2,500 pounds per square inch (psi) ~~to 3,500 psi~~. ***ADD-3***
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45
3. Slump Limit: Four inches, plus or minus one inch.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates to Architect for each batch discharged and used in the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

A. General: Form construction, isolation, and control joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

D. Control Joints: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a one-fourth-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed pavement surfaces with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

   1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.
   1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
   2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

D. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of reveal specified.
   1. Provide W. R. Grace "Top-Cast" or approved equal.
   2. Contractor to provide a submittal of material certificate with concrete submittal. Upon selection of color, submit 12”x12” sample of material in the specified color finish for review by Owner’s Authorized Representative in addition to the specified mock up. ***ADD-2***

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds/square feet by h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances as follows
   1. ACI 117 establishes few pavement tolerances; those in subparagraphs below are based on ACI 330.1.
   2. Elevation: One-fourth inch
   3. Thickness: Plus three-eighths inch minus one-fourth inch
   4. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed one-fourth inch.
   5. Joint Spacing: Three inches.
   6. Contraction Joint Depth: Plus one-fourth inch no minus.
   7. Joint Width: Plus one-eighth inch, no minus.

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel 1 inch beneath top of wheel stop.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.

C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 321400
UNIT PAVING

Revised, Addendum # 3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interlocking Concrete Paver Units (manually installed).
   2. Bedding and Joint Sand.
   3. Edge Restraints.
   4. Cleaner, Sealers, and Joint sand stabilizers.

B. Contractor's bid shall include all materials and services referenced in the Drawings and these Specifications, and shall be responsible for review and completion all these specification instructions herein.

C. Related Sections:
   1. Section 129300 - Site Furnishings
   2. Section 328400 - Irrigation Systems
   3. Section 329000 - Planting
   4. Section 329400 - Landscape Maintenance

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM C 33, Standard Specification for Concrete Aggregates.
   2. C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8, Freezing and Thawing.
   3. ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   4. ASTM C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   5. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.
   6. ASTM C 936, Standard Specification for Solid Concrete Interlocking Paving Units.ASTM C 979, Standard Specification for Pigments for Integrally Colored Concrete.
   7. ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft3 (600 kN-m/m3)).
   8. ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   9. ASTM D 2940, Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
   10. Interlocking Concrete Pavement Institute (ICPI):
   11. ICPI Tech Spec Technical Bulletins

1.3 SUBMITTALS

A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Sieve analysis per ASTM C 136 for grading of bedding and joint sand.

C. Concrete pavers:
   1. Four (4) representative full-size samples of each paver type, thickness, color, finish that indicates the range of color variation and texture expected in the finished installation.
   2. Accepted samples become the standard of acceptance for the work.
   3. Test results from an independent testing laboratory for compliance of concrete pavers with ASTM C 936.
   4. Manufacturer's certification of concrete pavers by ICPI as having met applicable ASTM standards.

5. Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.

D. Paver Installation Subcontractor:
   1. A copy of Subcontractor's current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
   2. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

E. Materials to be furnished:
   1. As part of this contract: upon completion of work for this section of the contract the contractor shall supply the following item to the District Representative:
      a. 400 square feet of paver field color of each type used, per the Construction legend and record drawings.
      b. 200 square feet of paver band colors of each type use, per the Construction legend and record drawings.
      c. Pavers shall be from the same production run as installed materials.

1.4 QUALITY ASSURANCE

A. Paving Subcontractor Qualifications
   1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
   2. Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

B. Mock-Ups
   1. Install a Mock up paver area.
   2. Use this area to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), color(s) and texture of the job.
   3. This area will be used as the standard by which the work will be judged.
   4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
   5. If mock-up is not retained, remove and properly dispose of mock-up.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers packaging with identification labels intact.
   1. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
   2. Deliver concrete pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
   3. Unload pavers at job site in such a manner that no damage occurs to the product.

D. Storage and Protection: Store materials protected such that they are kept free from mud, dirt, and other foreign materials. Store concrete paver cleaners and sealers per manufacturer's instructions.
   1. Cover bedding sand and joint sand with waterproof covering if needed to prevent exposure to rainfall or removal by wind. Secure the covering in place.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not install sand or pavers during heavy rain
   2. Do not install saturated sand.
   3. Do not install concrete pavers on saturated sand.

PART 2 PRODUCTS

2.1 INTERLOCKING CONCRETE PAVERS

1. Interlocking Concrete Pavers by Ackerstone or approved equal. Refer to plan for pattern, texture and finish: ***ADD-3***
2. Paver Type: As specify on construction drawings.
   a. Material Standard: Comply with material standards set forth in ASTM C 936.
   b. Color Pigment Material Standard: Comply with ASTM C 979.
   c. Average Compressive Strength (C140): 8000 psi (55 MPa) with no individual unit under 7200 psi (50 MPa) per ASTM C 140.
   d. Average Water Absorption (ASTM C 140): 5% with no unit greater than 7%.
   e. Freeze/Thaw Resistance (ASTM C 67): Resistant to 50 freeze/thaw cycles with no greater than 1% loss of material. Freeze-thaw testing requirements shall be waived for applications not exposed to freezing conditions.

2.2 PRODUCT SUBSTITUTIONS

1. Substitutions: ~~No substitutions permitted~~. Submit all substitutions in accordance with the Facilities Lease Agreement and Division 1. ***ADD-3***

2.3 BEDDING SAND

1. Bedding sand as follows:
   a. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
   b. Do not use limestone screenings, stone dust, or sand for the bedding sand material that does not conform to conform to the grading requirements of ASTM C 33.
   c. Do not use mason sand or sand conforming to ASTM C 144 for the bedding sand.
   d. Where concrete pavers are subject to vehicular traffic, utilize sands that are as hard as practically available.
   e. Sieve according to ASTM C 136.
   f. Bedding Sand Material Requirements: Conform to the grading requirements of ASTM C 33 with modifications as shown in Table 1.

Table 1
Grading Requirements for Bedding Sand
ASTM C 33

Sieve Size	Percent Passing
3/8 in.(9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075 mm)	0 to 1

2.4 EDGE RESTRAINTS

1. Provide edge restraints installed around the perimeter of all interlocking concrete paving unit areas as specified on contract drawings.

2.5 ACCESSORIES

1. Provide accessory materials as follows:
2. Sealers: 'Enhanced' stabilizing sealer by BP Pro Product or approved equal. BP Pro (714) 258-0800
3. Joint Sand. Polymeric Joint Sand by Logical Resource or approved equal. Logical Resource (760) 497-9690

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Only use ICPI certified installers.

3.2 EXAMINATION

A. Acceptance of Site Verification of Conditions:
   1. General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.
      a. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
      b. Verify that geotextiles have been placed according to drawings and specifications.
      c. Verify that aggregate and concrete base materials, thickness, compacted density, surface tolerances and elevations conform to specified requirements.
      d. Provide written density test results for soil subgrade, aggregate base materials to the Representative, General Contractor and paver installation subcontractor.
      e. Verify location, type, and elevations of edge restraints, concrete collars around utility structures, and drainage inlets.
   2. Do not proceed with installation of bedding sand and interlocking concrete pavers until subgrade soil and base conditions are corrected by the General Contractor or designated subcontractor.

3.3 PREPARATION

1. Verify base is dry, certified by General Contractor as meeting material, installation and grade specifications.
2. Verify that base is ready to support sand, edge restraints, and, pavers and imposed loads.
3. Edge Restraint Preparation:
   a. Install edge restraints per the drawings at the indicated elevations.

3.4 INSTALLATION

A. Spread bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 11/2 in. (40 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.
   a. Do not disturb screeded sand.
   b. Screeded area shall not substantially exceed that which is covered by pavers in one day.

B. Do not use bedding sand to fill depressions in the base surface.

C. Lay pavers in pattern(s) shown on drawings. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid pavers with rubber hammers and pry bars as required.

D. Joint (bond) lines shall not deviate more than ±1/2 in. (±15 mm) over 50 ft. (15 m) from string lines.

E. Fill gaps at the edges of the paved area with cut pavers or edge units. No smaller than 1/3 its original size.

F. Cut pavers to be placed along the edge with a double blade paver splitter or masonry saw (Diamond Blade).

G. NO PAVERS SHALL BE CUT LESS THEN 1/3 ITS ORIGINAL SIZE. If need be adjust or slightly deviate from pattern to insure there are no small cuts. It may be possible to use a paver adhesive to glue smaller cuts to an adjacent paver making it a solid unit. However with glue there should still be no cut size less than 1/3.

H. All edges and borders shall be set in concrete. Note that a large underlayment of a concrete should have smaller paver cuts adhered to underplayed concrete borders.

I. Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized. All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.

J. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint sand.

K. Use a low-amplitude plate compactor capable of at least minimum of 4,000 lbf (18 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Remove any cracked or damaged pavers and replace with new units.

L. Simultaneously spread, sweep and compact dry polymeric joint sand into joints continuously until full. This will require at least 4 to 6 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.

M. All work within 6 ft. (2 m) of the laying face shall be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted pavers with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.

N. Remove excess sand from surface when installation is complete. If Poly sand is used, Immediately sweep any excess joint sand from the surface in order to not have any sand stuck to the surface.

O. Surface shall be broom clean after removal of excess joint sand.

3.5 FIELD QUALITY CONTROL

A. The final surface tolerance from grade elevations shall not deviate more

B. than ± 3/8 in. (±10 mm) under a 10 ft (3 m) straightedge.

C. Check final surface elevations for conformance to drawings.

D. The surface elevation of pavers shall be 1/8 in. to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

E. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

3.6 CLEANING, SEALING, JOINT SAND STABILIZATION

A. Clean, Seal, Apply joint sand stabilization materials between concrete pavers in accordance with the manufacturer’s written recommendations.

3.7 PROTECTION

A. After work in this section is complete, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.

END OF SECTION

SECTION 328400
IRRIGATION SYSTEMS

Revised, Addendum # 3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Irrigation system consists of furnishing transportation, labor, materials, equipment and incidental services necessary to construct an irrigation system as shown on the Drawings and these Specifications Contractor's bid shall include all materials and services referenced in the Drawings and these Specifications, and shall be responsible for review and completion all these specification instructions herein.

B. Related Sections:

1. Section 129300 - Site Furnishings
2. Section 321400 - Unit Paving
3. Section 329000 - Planting
4. Section 329400 - Landscape Maintenance
5. Section 019113 - General Commissioning Requirements

1.2 REFERENCES

A. Comply with AB 1881 In particular the location of sprinklers, coverage and water use

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

1.	ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
2.	ASTM D1784	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
3.	ASTM D1785	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
4.	ASTM D2219	Standard Specification for Poly (Vinyl Chloride) Insulation for Wire and Cable, 60 Degrees C Operation.
5.	ASTM D2220	Standard Specification for Poly (vinyl chloride) Insulation for Wire and Cable 75 Degrees C Operation.
6.	ASTM D2241	Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure – Rated Pipe (SDR Service).
7.	ASTM D2464	Standard Specification for Threaded Poly (Vinyl Chloride) (PVC)Plastic Pipe Fittings, Schedule 80.
8.	ASTM D2466	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
9.	ASTM D2467	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe fittings, Schedule 80.
10.	ASTM D2468	Standard Specification for Acrylonitrile-Butaoliene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40.
11.	ASTM D2609	Standard Specification for Plastic Insert Fittings for Polyethylene(PE) Plastic Pipe.
12.	ASTM D2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
13.	ASTM D2855	Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

C. Local Plumbing Code

D. Uniform Plumbing Code

E. National Sanitation Foundation (NSF) Manual

F. Underwriters Laboratories (UL): Electrical wiring, controls, motors, and devices shall be U.L. listed, and so be labeled.

1.3 SUBMITTALS

A. Make submittals no later than 30 calendar days prior to start of work to which they apply.

B. Submit 6 complete lists of irrigation materials and equipment for approval by the Owner's Authorized Representative; include manufacturer's name and address, specific trade names, catalog numbers complete with illustrations and necessary descriptive literature and clearly mark or underline proposed items.

1. Approval of an item, alternate, or substitute indicates only that the product or products appear to meet the requirements of Drawings and Specification on the basis of the information or samples submitted.
2. Manufacturer's Directions: Where the manufacturer equipment is used in this Contract the manufacturer's Specifications and detailed Drawings shall be followed to provide installation methods not shown in the drawings and Specified herein.
3. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.
4. Manufacturer's specifications, catalog cuts, and other data required demonstrating compliance with the specified requirements.
5. Manufacturer's recommended installation procedures which, when approved by the Owner's Authorized Representative, will become the basis for accepting or rejecting actual installation procedures used on the job.
6. Equipment or materials installed or furnished without prior approval of the Owner's Authorized Representative may be rejected and the Contractor required to remove and replace such materials from the site at the Contractor's own expense.
7. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

C. Disapprovals: Promptly resubmit for approval necessary data concerning a substitution for a disapproved item.

D. Procurement List: Use the approved list of irrigation materials and equipment for procurement without deviation unless otherwise authorized in writing by the Owner's Authorized Representative.

E. Record Drawings

1. Provide and keep up-to-date Record Drawings, which shall be up-dated daily to show changes to the original Drawings and indicate the exact "as-built" locations of equipment. Prints for these purposes may be obtained from the Owner's Authorized Representative at cost. Record drawings shall be kept on the site at all times.
2. Record Drawings shall serve as work progress sheets and shall be the basis for measurement and payment for work completed. Drawings shall be available at all times for review and shall be kept in a location designated by the Owner's Authorized Representative. Should the record black digital bond print drawing progress sheets not be available for review or not be up-to-date at the time of any review, it will be assumed no work has been completed and the Contractor will be assessed the cost of that site visit at the current billing rate of the Owner's Authorized Representative. No other reviews shall take place prior to payment of that assessment.
3. The Contractor shall make neat and legible notations on the record drawing progress sheets daily, showing the work as actually installed.
4. Before the final site review, transfer information from the "as-built" prints to procured from the Owner's Authorized Representative. Dimensions shall be made so as to be easily readable including the final controller chart. The original print "as-built" plan shall be submitted to the Owner's Authorized Representative for approval prior to the making of the controller chart.
5. In addition to Record Drawing progress, dimension accurately from two (2) permanent points of reference (building corners, sidewalk, or road intersections), the location of the following items:
   a. Connection to existing water lines
   b. Connection to existing electrical power
   c. Gate valves
   d. Routing of sprinkler pressure lines (dimension) maximum 100'-0" along routing
   e. Remote Control Valves
   f. Routing of control wiring
   g. Quick coupling valves

h. Controller
i. Other related equipment as directed by the Owner's Authorized Representative
j. Sleeve locations

6. Controller Charts
   a. The Owner's Authorized Representative shall review as-built drawings before controller charts are prepared.
   b. Provide three (3) 11 inches x 17 inches controller charts for each controller supplied.
   c. Show the areas controlled by the controller valve sequence. Make the chart a 11 inches x 17 inches reduced drawing of the actual "as-built" system. However, in the event the controller sequence is not legible when the drawing is reduced, enlarge it to a size that will be legible when reduced.
   d. The chart shall be a black digital bond print. A different color shall indicate the area of coverage for each station.
   e. When completed and approved, hermetically seal the chart between two pieces of plastic, each piece being a minimum of 10 mils.
   f. These charts shall be completed and approved within 10 days of final inspection of the irrigation system.
   g. The above-mentioned equipment shall be turned over to The Owner's Authorized Representative at the conclusion of the project.
7. Operations and Maintenance Manuals:
   a. Prepare and deliver to the Owner's Authorized Representative within 10 calendar days after completion of construction, 3 hard cover binders with 3 rings containing the following information:
      1) Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representatives.
      2) Catalog and parts sheets on every material and equipment installed under this Contract.
      3) Warranty statements on equipment.
      4) Complete operating and maintenance instructions on equipment furnished.
   b. In addition to the above-mentioned maintenance manuals, provide the Department's maintenance personnel, through the Owner's Authorized Representative, with instructions for major equipment.
   c. Provide the Department with a reduced legible copy of the "As-Built" Irrigation Plan hermetically sealed in a plastic cover to be affixed to the inside of each controller cover.
8. Equipment to be furnished:
   a. As part of this contract: upon completion of work for this section of the contract the contractor shall supply the following items to the Owner's Authorized Representative.
      1) 2 sets of special tools required for removing, disassembling, and adjusting each type of Spray Heads and Remote Control Valve supplied.
      2) Two, 5 foot valve keys for operation of shut-off valve.
      3) 2 keys for each for automatic controller and cabinet.
      4) Key and Hose Swivel for Quick Coupler (QC): For 1 thru 5 QC installed provide one (1) Key and Hose Swivel, 6 thru 10 = 2, 11 thru 15 = 3, 16 thru 20 = 4 and so on.
      5) Remote Control Valve (RCV): Minimum One (1) valve for every size used. Total valve per size and provide One (1) valve for the first 10 installed of each sizes, 11 thru 15 = 2, 16 thru 20 = 3, 21 thru 25 = 4, and so on.
      6) One (1) Hand-Held Radio Remote Transmitter for Controller.
      7) Spray / Rotator Sprinkler Body: Equal to two percent of amount installed for each type and size indicated, but no fewer than ten units.
      8) Spray / Rotator Sprinkler Nozzle: Two for each type and size installed for each type indicated.
      9) Bubblers: Equal to two percent of amount installed for each type and size indicated, but no fewer than ten units.
      10) Emitters: Equal to two percent of amount installed for each type and size indicated, but no fewer than ten units.

1.4 QUALITY ASSURANCE

A. Work force

1. Experience: The landscape establishment firm shall have a full time foreman assigned to the job for the duration of the contract. He shall have a minimum of four (4) years' experience in landscape establishment supervision shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
2. Labor force: The landscape establishment firm's labor force shall be thoroughly familiar and trained in the work to be accomplished and perform the task in a competent, efficient manner acceptable to the Owner's Authorized Representative.
3. Supervision: The foreman shall directly employ and supervise the work force at all times. Notify The Owner's Authorized Representative of all changes in supervision.
4. Identification: Provide proper identification at all times for landscape establishments firm's labor force. Be uniformly dressed in a manner satisfactory to the Owner's Authorized Representative.

B. Ordinances and Regulations: All local and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made part of these Specifications. Nothing contained in these Specifications shall be construed to conflict with any of the aforementioned rules, regulations, or requirements. However, when these Specifications and Drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, then these Specifications shall take precedence.

C. Explanation of Drawings: Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, and sleeves which may be required. The Contractor shall carefully investigate the structural and finished condition affecting the work and install a complete irrigation system within the intent of the Drawings and Specifications, furnishing such fittings and miscellaneous materials as may be required. Drawings are diagrammatic and indicative of work and materials required.

D. Discrepancies:
1. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious upon field review that obstructions, grade differences or discrepancies in dimensions exist that might not have been considered in design. Differences shall be brought to the attention of the Owner's Authorized Representative. In the event this notification is not performed, the contractor shall assume full responsibility for any revision necessary.
2. Verify scaled dimensions and quantities prior to start of work.
3. Notify the Owner's Authorized Representative of discrepancies between Drawings and Specifications and actual job site conditions that would affect the execution of the irrigation work. Do not work in areas where discrepancies occur until instructed by the Owner's Authorized Representative in the event.

E. Permit and Fees: The Contractor shall obtain and pay for any and all permits and all inspections required by permits.

F. The new irrigation system tie-in shall meet all District standards as well as all the Owner's Authorized Standards and Design Criteria.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Exercise care in handling, loading, uploading and storage of pipes and fittings. Transport pipes in a vehicle allowing the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and, if installed, shall be replaced with new piping. Permission to store materials on site shall be obtained from the Owner.

1.6 INSPECTION

A. Notify the Owner's Authorized Representative 48 hours prior to time of the following required inspections:
1. Pressure supply line installation and testing.
2. Automatic controller and wire installation
3. .Lateral line and Sprinkler installation.
4. Coverage test.

B. Notify the District Representative 7 days prior to the time of final inspection.

1.7 PROJECT CONDITIONS

A. Existing Utilities and Plant Materials

1. Exercise care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by Contractor's operations or neglect. Check existing utilities drawings for existing utility locations. Contractor to verify all existing utilities through Dig Alert (800)-227-2600, two days before beginning construction.
2. Protect in place utilities and plant materials not designated for removal or modification against damage resulting from work of this Contract.
3. Repair or replace existing improvements not designated for removal, which are damaged or removed as a result of Contractor's operations. When a portion of a sprinkler system must be removed, the remaining lines shall be capped. Repairs and replacements shall be at least equal to existing improvements, and shall match them in finish and dimension.
4. Existing trees, lawns, and shrubbery that are not to be removed shall be protected from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in as nearly the original condition and location as is reasonably possible.
5. Costs for protecting, removing, and restoring existing improvements shall be included in Contractor's Bid.

B. Verification of Dimensions and Quantities

1. Verify scaled dimensions and quantities prior to start of work.
2. Notify the Owner's Authorized Representative of discrepancies between Drawings and Specifications and actual job site conditions that would affect the execution of the irrigation work. Do not work in areas where discrepancies occur until instructed by the Owner's Authorized Representative.

C. Water And Power Service

1. Service connection points shall be as shown on Drawings unless otherwise directed by the utility company.
2. Contractor shall be responsible for installing 120-Volt electrical service and all labor and materials including connections.
3. Upon final acceptance of work, transfer billing to the Owner's Authorized Representative.

1.8 WARRANTY

A. Guarantee and Repairs

1. The Contractor shall warranty irrigation system installation for 2 years commencing at ~~substantial~~ final completion in addition to the manufacturer's warranties. ***ADD-3***
2. The Contractor shall be responsible for coordinating material warranty items with manufacturer and distributor. The Contractor will be on call to replace or repair any faulty equipment or installation within 24 hours after notification by the Contracting Officer during the maintenance period.
3. The Owner's Authorized Representative reserves the right to make temporary repairs as necessary to keep the irrigation equipment in operating condition. The exercise of this right by the Owner's Authorized Representative will not relieve the Contractor of responsibilities under the terms of the guarantee.
4. Expenses due to vandalism during construction and the maintenance period shall be the responsibility of the Contractor. Maintenance period is as specified in section 02970 Landscape Maintenance.
5. A copy of the guarantee shall be in the operations and maintenance manual.
6. The Contractor shall be responsible for the irrigation system for two (2) years from the date of approval of ~~Substantial~~ Final Completion. The Contractor shall be responsible for the following tasks: ***ADD-3***
7. Replacement or repair of any broken or malfunctioning parts installed under this Contract, including heads, valves, and controllers.
8. Settling of backfilled trenches, which may occur during guaranty period, shall be repaired by Contractor at no expense to Contracting Officer, including complete restoration of finish grade treatment.

9. Guarantee Statement: Contractor to type on Contractor's letterhead the guarantee statement. The General Conditions and Supplementary Conditions of these Specifications shall be filed with the Owner's Authorized Representative prior to acceptance of the irrigation system.

B. Guarantee for Irrigation System

1. We hereby guarantee that the irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the Drawings and Specifications. We agree to repair or replace any defects in material or workmanship which may develop during the period of ~~one~~ two years from date of acceptance, ordinary wear and tear, unusual abuse or neglect excepted, also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional costs to the Owner's Authorized. We shall make such repairs or replacements within a reasonable time, as determined by the Owner's Authorized, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner's Authorized, we authorize the Owner's Authorized to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand. ***ADD-3***

PROJECT: _____

LOCATION: _____

SIGNED: _____

ADDRESSED: _____

PHONE: _____ DATE OF ACCEPTANCE: _____

1.9 SUBSTITUTIONS

A. Substitution of any product, material, or equipment without prior written approval of the Owner's Authorized Representative will not be permitted.

1. Approval of any item as a substitution or alternate shall be based on the following information, or, samples provided by the contractor:
   a. Provide a statement indicating the reason for making the substitution, using a separate sheet of paper for each item to be substituted.
   b. Provide descriptive catalog literature, performance charts, and flow charts for each item to be substituted.
   c. Provide the amount of cost savings if the substituted item is approved.
2. Be responsible for the total performance of such substitution to approved equal or surpass the original design in every respect.
3. If the substitution proved to be unsatisfactory in the opinion of the Owner's Authorized Representative, remove such work and install originally specified item.

1.10 MODIFICATION OF CONTRACT DRAWINGS

A. In each case where proposed substitute materials or equipment will require changes to the design of the project as indicated on Drawings, proposed revision drawings prepared by a licensed landscape architect, certified irrigation designer or engineer shall be furnished by the Contractor for installation of the proposed substitute materials or equipment and for construction by affected trades of the proposed revisions.

B. Cost of Drawings and of the proposed revised construction shall be borne by the Contractor.

1.11 INTENT OF DRAWINGS

A. Due to the scale of Drawings, it is not possible to indicate offsets, fittings, and sleeves, which may be required. Contractor shall investigate the finished conditions affecting the work and furnish fittings and other items, required to provide a complete irrigation system. Drawings schematically show the work to be installed

1.12 COORDINATION

A. Coordinate the irrigation installation with other sub-contractors including paving, utilities, site backfilling, landscape grading and landscape work.

PART 2 PRODUCTS

GENERAL

B. Irrigation plans have been prepared utilizing specific design standards, calculations, and criteria, including but not limited to the following: precipitation rates, flow rates, head spacing and coverage, flow rates, nozzle size and defined water window time frame. The Contractor shall be responsible for ensuring the installation of a complete and operating irrigation pump and irrigation system that meets or exceeds the design intent, standards, and parameters required by the plans and specifications.

C. The Contractor shall provide and install a complete and operating irrigation system, utilizing the same manufacturer and system parts as noted in the Drawings.

D. If all of the parameters, specifications and design intent of the Drawings are met, the following list of manufacturers with acceptable equipment model, series, size and designation, irrigation controllers; electrical connections; quick coupling valves; irrigation heads; drip and emitter irrigation piping and equipment) would be acceptable for use.

PIPE AND FITTINGS

E. Type of pipe material and fittings shall be in accordance with the following specification unless otherwise designated on Drawings:
   1. Plastic pipe shall be high impact rigid un-plasticized polyvinyl chloride PVC 1220 (Type 1, Grade 2), conforming to ASTM D1785, the minimum pressure rating to be not less than the working pressures indicated therein for the schedule and size listed. (PVC pipe marked with product standard PS-21-70 conforms to the ASTM requirements).
      a. Pipe to be homogeneous throughout and free from cracks, holes, foreign materials, blisters, deleterious wrinkles, and dents.
      b. Use Schedule 40 PVC plastic pipe for installation on the discharge side of control valves and Schedule 80 PVC plastic pipe for continuously pressurized pipe on the supply side of control valves, unless otherwise indicated.
      c. Use Schedule 80 PVC plastic pipe when threaded joints are specified.
      d. Continuously and permanently mark pipe with the following: Manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73 degrees Fahrenheit and National Sanitation Foundation (N.S.F.) approval.
   2. Fittings and couplings for plastic pipe shall be threaded adapters with socket pipe for connections to threaded pipe. No Marlex riser and street ells shall be used for swing joint assembly. No galvanized fittings and riser shall be used.
   3. Pipe shall be identified with the following indelible markings:
      a. Manufacturer's name.
      b. Nominal pipe size.
      c. Schedule of class.
      d. Pressure rating.
      e. NSF (National Sanitation Foundation) seal of approval.
      f. Date of extrusion.

F. Solvent Weld Pipe shall be manufactured from virgin poly vinyl chloride (PVC) compound in accordance with ASTM D2241 and STM D1784; cell classification 12454-B, Type 1, Grade 1.
   1. Fittings shall be standard weight, Schedule 40, injection molded PVC; complying with ASTM D1784 and D2466, cell classification 12454-B. UV rated fittings required for above ground installation.
   2. Threads – injection molded type (where required).Tees and Ells – Side gated.
   3. Threaded nipples shall be Schedule 80 with molded threads, ASTM D2464.
   4. Primer and Solvent cement shall be of the type and make approved by the pipe manufacturer for use on its pipe. Unless noted otherwise by manufacturer, primer shall meet ASTM F-656, and cement shall meet ASTM D-2564. Weld-On by Christy's or approved equal.
   5. Fittings and couplings for plastic pipe shall be threaded adapters with socket pipe for connections to threaded pipe. Plastic pipe fittings and couplings shall be PVC I or PVC I/II material supplied in the same schedule and size specified for the pipe. Indicate the type of plastic material, schedule, and size on each fitting or coupling.

VALVES AND VALVE BOXES

G. General: Provide valves of the type and capacity designated herein and with the requirements specified. Valves shall be capable of satisfactory performance at a working pressure of 200 psi. Valve design shall permit disassembly for replacement of seals without removal of the valve body from the pipeline.

H. Shut-Off Valves: In sizes 2 inch and smaller shall be all bronze double disc wedge type gate valve with integral taper seats and non-rising stems. Sizes 2 1/2 inches and larger shall be iron body, brass trimmed with other features as per 2 inch size (per plan).

1. Use 10 inch diameter round valve boxes for shut-off valves.

I. Master Remote Control Valves shall be type and size as specified on the drawings.

1. Valves shall automatically close in event of electrical power failure or due to breakage of pilot wire.
2. Valve shall be normally closed 24 VAC solenoid actuated glove pattern, spring-loaded diaphragm type. The valve shall be pressure rated up to 200 psi at 150 degrees F.
3. Valve shall have a 60-pound test fabric reinforced rubber diaphragm assembly with self-cleaning stainless steel screen.
4. Solenoid shall be corrosion proof and constructed of stainless steel molded in epoxy to form one integral unit, 24-volt AC watt maximum holding milliamp in-rush, current: 0.41 amp (9.i VA, holding current: 023 amp (5.5 VA).
5. Valve shall have pressure reducing and surge protection.
6. Use rectangular valve boxes for Master remote control valves.

J. Remote Control Valve Assembly shall be type and size as specified on the drawings: Electrically operated, with accurately machined valve seat surface, equipped with flow control adjustment, with capability for manual operation and readily disassembled for servicing; slow opening and closing; and self-cleaning (per plan). Valve box lid to be heat branded with “RCV”

1. Solenoid shall be corrosion proof and constructed of stainless steel molded in epoxy to form one integral unit, 24 volt AC watt maximum holding milliamp in-rush, current: 0.41 amp (9.i VA, holding current: 023 amp (5.5 VA).
2. Drip Remote Control Valve Assembly including Ball Valve and Drip Filter and union. The assembly to be placed in a box separated from the remote control valve assembly as necessary.
3. Remote Control Valve Assembly including Ball Valve and Union.
4. Use a rectangle valve box.

K. Quick-Coupling Valves and Assemblies: Quick coupling valves shall be two piece type of the size as specified on the drawings, 150-psi working pressure. They shall be all brass and so constructed that they automatically close when the coupler is removed. All such valves shall be equipped with vinyl or rubber cover.

1. Quick coupler key is part of this assembly.
2. Quick coupler assembly shall have a pre-assembled double o-ring PVC swing joint with a viton o-ring sealed brass MIPT nipple factory molded into the outlet end. Inlet shall be PVC MIPT. Assembly shall be ¾ inch size, 12 inch lay length and equipped with both horizontal and vertical supports. Vertical support shall allow for insertion of rebar stabilizing rods to secure the quick coupler.
3. Use 10 inch diameter round valve box for quick coupler

L. Basket Strainers shall be type and size per drawings.

M. Rectangular Valve Boxes: shall be 15 inches wide by 21.5 inches long by 12 inches high constructed of rigid HDPE (high-density polyethylene) resin, chemically inert plastic with valve box extensions where required. Valve boxes shall be embossed with valve number. Manufactured by Carson Brooks or approved equal. Carson Brooks 1200 Jumbo Series.

N. Round Valve Boxes: shall be 10 inches in diameter constructed of rigid polyethylene, chemically inert plastic with valve box extension where required. Valve boxes embossed with valve number. Manufactured Carson Brooks or approved equal. Carson Brooks #910-10 with T-Cover #910-4B and Bolt-Down option.

O. Valve Box Covers: shall be green in color for use with potable water.

1. Valve box covers shall be locking plastic covers.
2. Heat Branding: shall be accomplished using branding irons specifically designed for this purpose. Heat branding shall not weaken or in any way puncture the valve box cover. Identification letters or numbers shall be 2-inches high. Identification shall be as indicated below or on the detail drawings.
    a. Remote Control valve box shall be rectangular. Heat brand box lid with the appropriate program and station number. Heat branded with the letters "RCV."
    b. Quick Coupler valve box shall be round. Heat branded with the letters "QCV"
    c. Master Valve, box shall be rectangular, Heat branded with the letters "MV"
    d. Gate valve box shall be round. Heat branded with the letters "GV"
    e. Ball valve(BV) and pressure regulator (PR) and drip filter (DF).
    f. Air Relief Valve box shall be round. Heat branded valve box lid with "ARV"
    g. Flush Valve box shall be round. Valve box lid to be heat branded with "FV"
    h. Wire Splices box shall be rectangular. Heat brand with the letters "SB"
    i. Flow Sensor box shall be rectangular. Heat Brand lid with letters "FS"
    j. Traffic area valve boxes: Use precast concrete valve boxes with cast iron lid designed for vehicular traffic use.

ACCESSORIES

P. Gravel: All gravel used in valve boxes shall be washed crushed gravel of approximately ¾ inch size. No pea gravel shall be used.

Q. Identification Tags: yellow background with black lettering for potable water use, size 3"x4" by Christy's or approved equal. Label tags as it is labeled on valve box cover lid, section 2.03, I.

R. Waterproof Wire Connectors shall be 3M Scotchlok™ 3570 Connector Sealing Packs insulate or approved equal and provide protection for electrical spring connectors. Each sealing pack contains a specific amount of Scotchcast™ 400 epoxy resin and will accommodate one Scotchlok™ Y, R, G, B, 3M Brand 212, 312 or 512 electrical spring connector. Scotchcast™ 400 electrical insulating resin is a two-part epoxy insulating and encapsulating resin. This resin, mixed in its unique container bag, generates its own heat to cure.
    1. Resin must generates its own heat to cure, oil resistant, self-bonding, stable at elevated temperatures (up to 121°C). Include Unipak™ container bag for mixing the resin and encapsulating the appropriate spring connectors.
    2.
    3. The material must be Scotchcast™ 400 epoxy resin. It must be packaged in the 3M Unipak™ two-part polyethylene bag. The resin must be mixed within the Unipak™ container simply by separating the barrier between the two parts of the bag and between the two parts of the bag and the bag.

S. Control Wires: U.L. approved direct burial type U.F., 2-Wire cables shall containing two listed Sprinkler Systems Wires, single conductor, suitable for direct burial, for operation up to 600 volts, and temperatures up to 60ºC. Cable shall be manufactured by Paige Electric model number P7354D decoder cable direct burial 12 AWG solid copper with two conductors
    1. The inner conductors shall be soft drawn bare copper meeting the requirements of ASTM specification B-3 or B-8. Insulation shall be low density high molecular weight polyethylene and a thickness of 0.045", per Paige Electric specification P7079D. The two conductors (blue and red) shall be twisted with a minimum lay of 4".
    2. The overall jacket shall be High density polyethylene with a thickness of 0.035". Available with different color jackets. The jacket shall be sufficiently round, and loose, to facilitate its removal when being stripped. Minimum inner diameters of the outer jacket shall be 0.358 inches for 14 AWG/2c and 0.386 inched for 12 AWG/2c.
    3. The surface of the inner conductors shall be printed "Paige Electric P7079D 14 AWG PE Listing file Number 600V Sprinkler System Direct Burial" and the surface of the outer jacket shall be printed "Paige Electric, P7354D, 14 or 12 AWG PE 600V Sprinkler System Wire Direct Burial.
    4. Temperature rating of the cable -55ºC to +60ºC
    5. Paige Electric recommends the strict use of Model DBR/Y-6, as manufactured by the 3M Company (Paige specification P7364D).

T. Detectable Underground Warning Tape: Consists of a minimum 4.5 mil (.0045") overall thickness by 3" wide with a solid aluminum foil core. The imprinted warning message is "Caution Buried Irrigation Line Below" to prevent ink rub-off, and is impervious to acids, alkalis and other destructive elements found in the soil. The imprint is as such that it allows for total reflectivity. A tape must be visibly seen before it can be read. APWA Color coded

CONTROLLER UNIT

U. Controller(s)shall be Calsense CS3000 controller, and shall be installed per manufacturer's specifications, as shown on the drawings, and as specified herein.

V. The irrigation system controller shall be capable of fully automatic, semi-automatic, test and manual operation. The stainless steel enclosure controller enclosure shall be per Section 2.08.

W. The controller shall operate on a input of 120 VAC, 60 Hz, 1.0A and a 40VA transformer with output of class 2, rated 24 VAC, maximum total load 1.5A and be capable of actuating up to five .25A solenoids plus a master valve or pump start relay. The controller shall operate three stations plus the master valve simultaneously.

X. The controller shall have a backlit 16 line by 40 character display where information can be viewed at once without scrolling through menus including an area description for each station 40 characters long such as where it is located, the type of plant material irrigated, and type of equipment used.

Y. The controller shall have 7 regular irrigation programs plus two syringe/propagation program, with individual station Cycle & Soak watering,

Z. The controller shall have a water budget feature that provides monthly water volume budgets proportionate to historical ET and interactive with all programs, and able to alert user when controller's water usage is more than a user set water budget.

AA. The controller shall have programming based on a 7,14, 21 or 28 day scheduling and be able to irrigate in minutes, inches, percent of ETo and/or soil moisture content.

BB. The controller shall have the capability to have a full year master schedule to allow 12 month programming.

CC. The controller shall have the ability to display area, plant and/or equipment descriptions for each station.

DD. The controller shall be capable of programming all or a group of stations with the same run time and soak-in time by using a Copy key.

EE. The controller shall be capable of operating a test program without affecting the controller's normal program station times or without terminating a regular watering schedule.

FF. There shall be complete English and Spanish operator's manual built in the controller and viewed in the controller's display.

GG. The controller shall have internal non-volatile memory capable of lifetime program memory retention without the use of batteries.

HH. The controller shall be capable of reading a flow sensor and automatically "learn" each station's average GPM flow rate on a continuous basis.

II. There shall be a built-in amperage meter to accurately measure display and diagnose valve solenoid electrical problems such as 'No Current', 'Station Short', 'Under Current', 'Over Current', etc.

JJ. The controller operating as a satellite shall be capable of irrigating the program entered by the central (base computer) or by programming at the satellite location, without having to go back to the central to accept the change. The controller shall allow individual station operation of any field satellite units. Controller shall also be capable to remotely perform all satellite keystroke operation from the central (base computer) utilizing an on-screen graphics replica of the satellite controller panel.

KK. The controller shall be able to log for each station for the last 30 watering days the following information:

1. Time and date irrigation ran
2. Number of repeat cycles run
3. Programmed minutes and actual minutes run
4. Programmed inches and actual inches applied
5. Manual & Test minutes
6. No Water days programmed
7. Hold-Over Time
8. Actual GPM flow rate that night compared to Learned or Limit value
9. Alert Flags

LL. The controller shall have an operator-set water window. Irrigation will not continue past a set end time. Remaining run-times will be carried over in a hold-over table to be applied at next scheduled irrigation and the system will prioritize which valve to operate based on this held-over time.

MM. Multi-level Access protection settable using central software. Controller will log when user signed in and when user signed out. This allows the user to create management of the system any way he or she chooses.

NN. Optional Radio Remote receiver board shall be built-in the controller and a hand-held radio remote transmitter will be supplied as specified on Drawings so that the end user can trouble shoot valves remotely without having to go the controller itself. The Remote Sensor shall have the ability to display information in the handheld including flow rate and electrical draw of the operating outputs. Editable station information available to view and edit at the handheld include total minutes, minutes per cycle, soak in time, expected flow rate, and square footage. The keypad shall be user-friendly and provide for immediate intuitive operation.

OO. Controller shall have a detailed water usage report categorizing for each month the usage during scheduled irrigation, during test and manual key operation, and when valves are bled manually or quick couplers are used.

PP. The controller shall have manual functions that include test and manual for individual as well as groups of valves, two separate syringe, manual programs with six start times each, as well as a Walk Thru Program that allows a programmed delay time to get to a certain area and then manual water a sequence of predetermined stations for set program times.

QQ. The controller shall communicate with other controllers in line-of-sight proximity using spread-spectrum radios, providing a reliable communication link instead of a hardwire communication path when sharing data. The spread-spectrum radio option(-SR) does not require FCC licensing, and offers a secure error correcting frequency hopping radio link immune to outside interference. A single controller model number shall be –SR, while multiple controllers sharing a single spread-spectrum radio shall be designated as a –SR-M and –M configuration.

CONTROLLER ENCLOSURE(S)

RR. The enclosure shall be of a vandal and weather resistant nature manufactured entirely of 304-grade stainless steel, top 12 gauge and the body 14 gauge. The main housing shall be louvered upper and lower body to allow for cross flow ventilation. A stainless steel backboard shall be provided for the purpose of mounting electronic and various other types of equipment. The backboard shall be mounted on four stainless steel bolts that will allow for removal of the backboard.

SS. The 38-inch height with flip top shall provide easy access for easy programming from a standing position under normal installations.

TT. The pre-assembled vandal resistant enclosure shall come complete with lightning and surge protection. All terminals shall be factory labeled. On/Off switch provided to isolate controller along with GFI receptacle. Radio antenna shall be pre-mounted and connected on SSE-R enclosure for radio remote capability. Enclosure includes 2-7/8 inch 1-1/2 inch thick, 6-pin cylinder, die-cast steel padlock with unique shackles design.

UU. Factory pre-assembled enclosure with controller shall carry full UL listing.

VV. Factory pre-assembled enclosure with controller shall carry a 10-year limited warranty.

WW. Enclosure shall be mounted on a poured-in-place concrete pad.

ELECTRICAL

XX. Supply line voltage conductors with THW/THWN, 600-volt insulation rating, per ASTM D2219 and D2220.

YY. Rigid electrical conduit shall be Schedule 40 galvanized steel, threaded and bushed with packing placed in the ends to protect the wiring. Sweep ends of conduit into pull boxes to make splices.

FLOW MONITORING SENSOR

ZZ. Flow Meter and cable shall be type and size as specified on Drawings, one red wire, and one black wire in 1-1/4" PVC conduit to connect to the irrigation controller. The maximum wire run between flow meter and controller shall be 2000 ft. The flow meter sends low voltage digital pulses back to the controller and therefore all electrical connections must be waterproof and resist any moisture entry.

AAA. It is intended that all wire runs between the controller and flow meter be direct pulls and have no splices. If wire splices are unavoidable, they must be installed in a valve box with 3M Scotchlok 3570 connectors or approved equal.

BBB. Each flow meter shall have the following characteristics:

1. Housing to be a Sch 80 polyvinyl chloride tee or bronze tee
2. Have a pulsing output that operates at 9 VDC and a pulse rate that is proportionate to the GPM
3. Fully compatible with the internal interface at each field controller
4. Powered by the controller
5. Replaceable metering insert
6. Shall feature a six-bladed design with a proprietary, non-magnetic sensing mechanism
7. Be by the same manufacturer as the irrigation controller.

CCC. Single controller shall be able to receive up to three separate flow meter inputs on projects consisting of more than one water source for irrigating landscape. The controller shall sum up the readings of all flow sensors connected.

SPRINKLER EQUIPMENT

DDD. Sprinklers, rotors, bubbler heads, and spray nozzles shall be of the types and sizes shown on Drawings, with plastic nozzles unless otherwise indicated.

EEE. Nozzles: Provide equipment of one type and flow characteristic from the same manufacturer and bearing the manufacturer's name and identification code in a position where they can be identified in the installed position.

FFF. Provide fixed head sprinklers with a one piece housing and with provisions for interior parts replacement. Pop-up sprinklers to rise 12 inches in shrub areas, 6 inches in turf areas. Sprinklers on fixed riser to be at least 12 inches above grade and 2 inch for fixed bubblers.

GGG. Inline anti drain check valve shall be used to prevent low head drainage. Hunter HCV anti drain valve or approved equal.

LOW FLOW WATERING SYSTEM

HHH. Refer to irrigation plans and legends for low flow watering system.

PART 3 EXECUTION

IRRIGATION SYSTEM INSTALLATION

III. General:

1. Notify Owner's Authorized Representative in writing at least 48 hours before testing will be conducted Conduct tested in presence of the Owner's Authorized representative.
2. Perform work on the irrigation system, including hydrostatic and coverage tests, preliminary operational test of the automatic control system, and the backfill and densification of trenches and other excavations after topsoil work and before planting.
3. Prior to installation, stake out pressure supply line routing and locations of spray heads, tree bubblers, Low flow irrigation system lines.

4. Plant large specimen plants (24 inch box or larger) before installing the irrigation system; reroute irrigation lines conflicting with specimen plant locations to clear the root ball.
5. With the Owner's Authorized Representative's approval, make adjustments where necessary to conform to actual field conditions unless otherwise noted. Irrigation system layouts shown on Drawings shall be considered schematic or diagrammatic.
6. Make the irrigation system operational with uniform coverage of the areas to be irrigated, prior to planting.
7. Piping on Drawings shown in paved areas running parallel or adjacent to planted areas, are intended for design clarification only and shall be installed in the planted area whenever possible.
8. Make water and utility connections as shown on Drawings or as approved by the Owner's Authorized Representative. If utility connections are not shown on Drawings, Contractor shall estimate 100 feet to each service point. Replace sidewalks, curbs, or paving removed by the installation of the water and electrical meters and service.

TRENCH EXCAVATING AND BACKFILLING

JJJ. Size trenches and other excavations to accommodate the irrigation system components, conduits, and other required facilities. Provide additional space to assure proper installation and access for inspections.

1. Trenching for irrigation system shall be done after completion of soil conditioning and finish grading operations.
2. Unless otherwise specified, the minimum depth of cover over pipelines and conduits shall be as follows:
   a. Electrical conduit: 24 inches (36 inches under roadways, driveways, and parking lots).
   b. Waterlines continuously pressurized: 18 inches (24 inches under roadways, driveways and parking lots).
   c. Lateral sprinkler lines: 12 inches. (18 inches under roadway and parking lots)
3. Make the bottom of trenches true to grade and free of protruding stones, roots, or other matter which would prevent bedding of pipe or other facilities.

KKK. Trenches shall not be backfilled until required tests are performed.

1. Backfill trenches so that the specified thickness and density of the topsoil is restored throughout the entire depth of the trench.
2. Backfill may be flood compacted in landscaped areas to a dry density equal to adjacent soil in planting areas. Backfill shall join flush to adjacent grades without dips, sunken areas, humps or other surface irregularities.
3. Mechanical compacted backfill shall be by means of hand-directed mechanical tampers in 4 inch lifts or roller equipment including sheeps foot, grid, smooth wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheel in maximum 12 inch lifts.

LLL. Compact trench backfill through paved areas in 8 inch layers to 90 percent relative compaction up to sub grade to receive paving and base material.

1. Resurface trenches through paved areas to match existing pavement.

MMM. If settlement occurs and subsequent adjustments of pipes, valves, irrigation heads, planting areas, or other construction are necessary, Contractor shall make required adjustments without additional cost to the Owner.

IRRIGATION PIPELINE INSTALLATION

NNN. General: Execute trench excavating and backfilling, including the depth of cover over the pipeline.

1. Install pipe fittings in accordance with the manufacturer's written recommendations and Reference Specifications. Furnish the Owner's Authorized Representative with the manufacturer's printed installation instructions which deviate from specifications, for approval before pipe installation.
2. Bed pipe in at least 2 inches of finely divided soil to provide a firm, uniform bearing. Surround the pipe with additional finely divided soil to at least 2 inches over the top of the pipe.
3. Deposit trench backfill to anchor the pipe before the pipeline pressure testing, except that joints shall remain exposed until satisfactory completion of testing.

4. When 2 or more pipelines are installed in the same trench, separate the pipelines by a minimum horizontal clear distance of 4 inches. Install them so that each pipeline, valve, or other pipeline component may be serviced or replaced without disturbing the other.
5. Make assemblies as specified and in accordance with the manufacturer's directions or as detailed on Drawings.
6. During installation of pipe, fittings, valves, and other pipeline components, prevent foreign matter from entering the system. Temporarily cap or plug open ends at cessation of installation operations.
7. Make changes in pipeline size with reducer fittings. Do not use close nipples or bushings.
8. Place mainlines under paving in Schedule 40 PVC sleeves. Oversize the sleeves 2x to house the pipe, fittings, and control wires.
9. Separate dissimilar metals by an approved "Dielectric" coupling.

OOO.Plastic Pipeline:

1. Join plastic pipe with socket type solvent welded fittings, threaded fitting, rubber ring fittings or by other means specified. Install steel pipe first when plastic pipe is joined to steel pipe.
2. Cut pipe using a pipe cutter, do not use a saw. Cut square, externally chamfer approximately 10 to 15 degrees and remove burrs and fins.
3. On PVC to metal connections, work the metal connections first. Teflon tape or approved equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints.
4. Make solvent welded joints in accordance with ASTM D2855. Use the primer and solvent recommended by the pipe manufacturer. Do not use solvent with threaded joints.
5. Install plastic pipe in accordance with ASTM D2774 and the requirements herein.
6. Exercise care in assembling pipeline with solvent welded joints so that stress on previously made joints is avoided. Handling of the pipe following jointing, such as lowering the assembled pipeline into the trench, shall not occur prior to the set times specified in ASTM D2855.
7. Apply primer and solvent to pipe ends so that no material is deposited on the interior surface of the pipe or extruded into the interior of the pipe during jointing. Wipe off excess cement on the exterior of the joint immediately after assembly. Install No multiple assemblies in plastic lines. Provide each assembly with its own outlet.
8. Protect pipe from tool damage during assembly. Use vises with padded jaws and strap wrenches for installation of fittings and nipples.
9. Remove and replace plastic pipe which has been nicked, scarred, or otherwise damaged.
10. Snake plastic pipe from side to side in the trench to allow 1 foot of expansion and contraction per 100 feet of straight run.
11. Do not expose the pipeline to water for 24 hours after the last solvent welded joint is made.

INSTALLATION OF VALVES, VALVE BOXES, AND SPECIAL EQUIPMENT

PPP.Install valves and equipment in accordance with the details in a normal upright position, unless otherwise recommended by the manufacturer, and make readily accessible for operation, maintenance, and replacement.

QQQ.Install valves of the same size as the pipeline in which they are installed, unless otherwise indicated on Drawings.

RRR.Install shut-off valves and sectional automatic control valves using brass or bronze unions with copper or brass seats, below ground.

SSS.Install quick-coupler valves and hose bibs projecting above grade 1 foot from curbs, pavement, and walks when possible.

TTT.Set valve boxes to finish grade on a minimum 12 inch deep layer of gravel and set valves at depth to provide clearance between the cover and valve handle or key when the valve is in the fully open position. Do not cover valve with gravel.

UUU.Install a line sized shut-off valve on the pressure side of all sectional remote control valve.

VVV.Install a line size shut–off valve in a 10 inch diameter valve box on the up-stream side of main lines crossing streets.

REPAIR/RESTORATION

WWW.The Owner's Authorized Representative reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by The Owner's Authorized Representative shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

IRRIGATION HEAD INSTALLATION AND ADJUSTMENT

XXX.Flush and pressure test mains and laterals, and risers before installing irrigation heads, Low Flow Irrigation System and Tree Bubblers and before performing water coverage test to the complete satisfaction of the Owner's Authorized representative.

YYY.Location, Elevation and Spacing:

1. Install the spray heads in accordance with Drawings.
2. Spacing of spray heads shall be installed for head to head coverage. In no case shall the spacing exceed the maximum recommended by the manufacturer.
3. Install irrigation heads adjacent to curbs, walks, paving, and similar improvements on pop-up spray bodies with tops set flush to finished grade.

ZZZ.Riser installation:

1. Install riser perpendicular to finished grade to obtain optimum coverage of the area.
2. Provide threaded pipe between the connection to the lateral or main and the sprinkler head.
3. Riser assemblies shall be triple swing joint type with Schedule 80 PVC nipples and threaded fittings.
4. Install check valves to prevent low head drainage.

AAAA.Irrigation Head Adjustment:

1. When irrigation heads are installed and the irrigation system is operating, adjust and balance each section or unit with section control valves fully open to obtain uniform and adequate coverage.
2. Flush and adjust all Sprinkler Heads, Tree Bubbler and Low Flow Irrigation for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
3. At no time shall the irrigation system to spray water on pavement and structures.

BBBB.Low Flow Irrigation System Installation

1. All emitters and heads shall be set perpendicular to the finish grade.
2. Low Flow Irrigation lateral lines shall be buried 8 inches below grade.
3. Contractor shall flush out all lines prior to backfill and adjust valves for optimum coverage.
4. To flush single emitter with flush stem, flush cap must be unscrewed before flushing can begin and must be completely retightened after completion of each system flush.
5. Emitter tube in planter areas to remain 2 inches above finish surface.
6. All trenches to be backfilled, leveled, and compacted to the same relative compaction as the natural soil. No settling of trenches will be acceptable

CONTROLLER SYSTEM INSTALLATION

CCCC.Install controller per manufacturer's instructions. Contractor shall have 5 years of experience installing Calsense Controllers. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings.

DDDD.Control system to be certified by Calsense. Submit certification to the Owner's Authorized Representatives. Contact Mark Huntzinger at Calsense at 760-580-1827. Certification shall state the Controller is connected and is sending and receiving information from all necessary irrigation equipment especially the Flow Sensor and Master Valve.

EEEE.Install a complete automatic irrigation control system, including the 120 Volt electrical service, automatic controller, automatic control valves and wiring, and necessary accessories and utility service connections as required by the controller manufacturer.

FFFF.Install the automatic controller outside of the coverage pattern of the irrigation system at the location designated on Drawings or as directed by the Owner's Authorized Representative in accordance with the details.

GGGG.Install a separate disconnect switch between the source of power and the controller. Fuse control components in the controller and ground the chassis.

HHHH.Install service wiring at a minimum depth specified, in galvanized steel electrical conduit from the service point to the controller. The minimum service wire shall be No. 12 AWG copper 600 volt type THW/THWN insulation, or as required by the controller manufacturer. Locate splices only in specified pull boxes and make splices with a waterproof packaged kit approved for underground use. Set top of pull boxes flush to finish grade on a 12 inch deep layer of ¾ inch gravel.

IIII. House control wiring in a conduit between the controller and an electrical pull box at the base of the controller. House control wire under paved areas in a Schedule 40 PVC pipe sleeve. Other wiring issuing from the electrical pull box shall be direct burial, installed in the main or lateral waterline trenches wherever practicable.

JJJJ.Color code common wire white with control wire any color except white. Make splices in control wire with approved waterproof connectors in accordance with the requirements for service wire. Leave at least 2 feet of coiled slack at each splice and point of connection inside the valve boxes.

KKKK.Test wiring for continuity, open circuits, and unintentional grounding prior to connection to equipment.

LLLL.Leave the control system in operating condition with an operational chart mounted within the controller cabinet upon completion of the work.

FLUSHING AND TESTING

MMMM.Flushing: After completion, and prior to the installation of terminal fittings, flush the entire pipeline system through strainer until there is no longer any evidence of debris. After flushing, conduct the following tests in the sequence listed below. Provide equipment, materials, and labor necessary to perform the tests. Conduct tests in the presence of the Owner's Authorized Representative.

1. Pipeline Pressure Test: Perform a water pressure test on pressure mains before couplings, fittings, valves, and the likes are concealed. Cap open ends after the water is turned on to the line so that the air will be expelled. Test pressure mains with control valves to lateral lines closed. The constant test pressure and the duration of the test are as follows:
2. Pressure line (Mainline): 4 hours at 150 psi.
3. Spray Coverage Test: Perform the coverage test in the presence of a Owner's Authorized Representative after sprinkler heads have been installed and before groundcover has been planted, to demonstrate that each section or unit in the irrigation system is complete and balanced to provide uniform and adequate coverage of the areas serviced. Correct deficiencies in the system.
4. Operational Test: Evaluate the performance of components of the automatic control system for manual and automatic operation. During the maintenance period, and at least 15 days prior to final inspection, set the controller on automatic operation so that the system will operate during such period. Make repairs, replacements, and adjustments until equipment, electrical work, controls, and instrumentation are functioning as specified.

FINAL INSPECTION PRIOR TO ACCEPTANCE

NNNN.Operational Test:

1. Evaluate the performance of components of the Automatic Control System for manual and automatic operation. During the maintenance period, and at least 15 days prior to final inspection, set the Controller on automatic operation so that the system will operate during such period. Make repairs, replacements, and adjustments until equipment, electrical work, controls, and instrumentation are functioning as specified.

OOOO.Inspection for final acceptance of the irrigation system shall occur together with inspection for final acceptance of plantings at end of the Plant Establishment Period as specified in PLANTING Section.

PPPP.Contractor shall operate each system with hand held remote control for the Owner's Authorized Representative at time of final inspection. Items deemed not acceptable by the Owner's Authorized Representative shall be reworked to the satisfaction of the Owner's Authorized Representative.

QQQQ.Contractor shall show evidence to the Owner's Authorized Representative that the Owner has received accessories, charts, record drawings, and equipment as required before final inspection can occur.

RRRR.Contractor shall make available hand held remote control for all field inspection.

CLEANUP

SSSS.Cleanup shall be made as each portion of work progresses. Remove refuse and excess dirt from the site. Walks and paving shall be broom swept or washed down daily, and damage done on the work of others shall be repaired to the satisfaction of the Owner's Authorized Representative.

END OF SECTION

SECTION 329000
PLANTING

Revised, Addendum # 3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Furnish all labor, material, equipment and services necessary to provide all landscape planting, complete in place, as shown and specified herein, including soil preparation, planting, seeding, staking and clean-up.
   2. Any plant deemed 'Not Available' shall be noted in the bid. Failure to qualify availability of specified material shall make the Contractor responsible for all supplying of all material. Maintenance period may not begin until specified materials are installed.

B. Related Sections:
   1. Section 129300 - Site Furnishings
   2. Section 321400 - Unit Paving
   3. Section 328400 - Irrigation Systems
   4. Section 329400 - Landscape Maintenance

C. Reference Standards:
   1. American Society for Testing and Materials (ASTM International):
      a. ASTM A36 Standard Specification for Carbon Structural Steel
      b. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
      c. ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
      d. ASTM D2434 Standard Test Method for Permeability of Granular Soils (Constant Head)
   2. Council of Tree and Landscape Appraisers:
      a. Manual for Plant Appraisers Handbook, Guide for Establishing Values of Trees and Other Plants.
   3. State of California Agricultural Code
   4. Sunset Western Garden Book
      a. Sunset Publishing Corporation, 2012 Edition
   5. U.S.A. Standards for Nursery Stocks
      a. American Nursery & Landscape Association, ANSI Z60.1-2014

1.2 SUBMITTALS

A. Certification: From a qualified arborist that the trees indicated to remain have been protected during construction according to recognized standards and that tree is promptly and properly treated and repaired when damaged.

B. Submittals for review during construction phase:
   1. Manufacturer's or vendor's certified analysis for all herbicides, fertilizers, soil amendments, staking and guying materials.
   2. The Owner’s Authorized Representative reserves the right to take and analyze samples of materials for compliance at any time. Furnish samples upon request by The Owner’s Authorized Representative. Rejected materials shall be immediately removed from the site at the Contractor's expense. Cost of testing of materials not meeting these specifications shall be paid by The Contractor, except for any imported top soil which will include testing as part of any additional cost.

3. Submit documentation to the Owner's Authorized Representative within forty-five (45) calendar days after date of Owner approval of final plans that all plant material is available. The Contractor shall be responsible for all material listed on plant list. Any and all substitutions due to availability shall be requested in writing prior to confirmation of ordering. All materials shall be subject to observation by the Owner's Authorized Representative at any time after confirmation of ordering. The list should also be submitted to Wallace Laboratories to confirm plant/soil compatibility.
4. Submit proposed planting schedule indicating anticipated dates for each type of landscape work. Once accepted, revise schedule only as approved in writing.
5. Submit 4" x 7" (or larger) color photos of all plant materials to be installed on the project site as noted on the Contract Documents.
6. Plants shall be subject to observation and preliminary acceptance by the Owner's Authorized Representative at place of growth or upon delivery for compliance with these specifications.
    a. Submit written request for observation of plant material 24" box size or larger at place of growth to The Owner's Authorized Representative. Written request shall state the place of growth and quantity of plants to be observed. The Owner's Authorized Representative reserves the right to refuse observation at this time if, in his judgment, a sufficient quantity of plants is not available for review.
    b. Such observation shall not impair the right of observation and rejection during progress of the work.
    c. Tagging of plant material by The Owner's Authorized Representative is for design intent only and does not constitute the Owner's Authorized Representative's approval of the plant materials in regards to their health and vigor.
    d. The health and vigor of the plant materials is the sole responsibility of the Contractor.
7. Submit specifications of any item being used on site upon the request of the Owner's Authorized Representative.

C. Certifications:

1. Submit a certificate if requested by The Owner's Authorized Representative of delivery slip with each delivery of material in containers or in bulk. Certificates shall state source, quantity, or weight, type and analysis and date of delivery. Materials which are not pre-packaged shall have analysis completed by Wallace Laboratories (310) 615-0116 or approved equal (see plans). Deliver all certificates to The Owner's Authorized Representative s prior to installation, incorporation or application of the material.
    a. Quantities of fertilizer.
    b. Quantities of soil amendments

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: The landscape establishment firm shall provide at least one English-speaking person full time assigned to the job for the duration of the contract. He shall have a minimum of four (4) year experience in landscape establishment supervision, with experience or training in tree maintenance, entomology, pest control, soils, fertilizers, and plant identification.
2. Supervision: The foreman shall directly employ and supervise the work force at all times. Notify the District Representative of all changes in supervision.
3. Labor Force: The landscape establishment firm's labor force shall be thoroughly familiar and trained in the work to accomplished and perform the task in a competent, efficient manner acceptable to the District Representative.
4. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience.
5. Installer Qualifications: Company specializing in installing and planting the plants with six year experience.
6. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.
7. Tree Pruning: NAA - Pruning Standards for Shade Trees to be followed.
8. Maintenance Services: To be performed by the landscape installer.
9. Identification: Provide proper identification at all times for landscape establishments firm's labor force.
    a. Be uniformly dressed in a manner satisfactory to the Owner's Authorized Representative.

B. Materials and Workmanship:

1. Observations:
   a. In all cases where observations are required, notify the Owner's Authorized Representative at least four working days in advance of the time of observation.
   b. The Contractor shall schedule and make available the information and materials indicated for review by the Owner as listed herein after. Observation by the Owner's Authorized Representative shall not relieve the Contractor of completing the work in conformance to the Contractor Documents
   c. Observation of site at critical stages of work.
   d. Observation for approval of landscape finish grading and soil preparation before installation of plant material:
      1) During this observation the Owner's Authorized Representative may request that samples of the prepared soil be analyzed by an approved laboratory to assure its compliance with these Specifications.
      2) Notification of exception shall be to correct deficiencies in the soil preparation to render it in compliance with these specifications. Corrections shall be made prior to any planting; the installation of container sized plants may proceed if the corrections can be made later without affecting the quality of the work. Notify the Owner's Authorized Representative in writing when the deficiencies have been corrected.
         (a) Observation of planting installation.
         (b) Observation of tree staking.
   e. Observation by the Owner's Authorized Representative will be made at ~~substantial~~ final completion of all materials, construction and installation work required by the Contract Documents prior to commencement of the plant establishment period. The plant maintenance period shall not commence until all deficiencies found by this observation have been corrected and written notice of start of commencement has been received from the Owner's Authorized Representative. All materials shall be installed prior to this observation with the following exceptions: ***ADD-3***
      1) Items waived by the Owner's Authorized Representative for this observation for reasons of substantiated unavailability, or in appropriate season or weather.
      2) Items which do not affect the health or growth of the plantings.
   f. Periodic observation shall be made of the work of the Contract Documents during plant establishment period.
2. Materials:
   a. Specimen and 24" box size or larger plant materials shall be observed at source prior to delivery to site.
   b. Upon delivery of plant material to site:
   c. All plant material shall be observed and approved by the Owner's Authorized Representative for quality, size and variety prior to installation. Such approval shall not impair the right of observation and rejection during the progress of work for size and condition of ball or root mass, latent defects, diseases, pests or injuries.
   d. A maximum of two observations for approval of plant material will be made by The Owner. For the first observation, present not less than 50% of the total of required plant material. Submit the remainder at the second observation.
   e. If any defective or non-complying plants are found during observations, they will be rejected.
   f. All rejected plant material shall be removed from the site within a minimum of two working days.
   g. Site Soil Quality:
      Contractor shall provide preliminary site soils sample to determine suitability of existing soil with plant material specified. Take one (1) representative soil sample from area identified in the Drawings and submit with a site map showing location to the District's selected testing laboratory. If import soil is required, Contractor shall identify a source for top soil that shall be tested by District's lab. District will incur the costs to test up to two (2) sites for top soil within a distance of 70 miles of the project location. The costs for the need to test more than two (2) sites shall be incurred by the Contractor. ***ADD-3***
      ~~Contractor shall provide preliminary site soils test to determine suitability of existing soil with plant material requested by the Owner's Authorized Representative.~~

~~If import soil is required, the Owner's Authorized Representative or the Contractor shall identify a source for top soil that will be tested by the following lab as an additional cost to the project.~~

~~Take one (1) representative soil sample from area identified in the Drawings. Submit with a site map showing locations to Wallace Laboratories, 365 Coral Circle, El Segundo, CA 90245 (310) 615-0116 or approved equal.~~

Soil samples shall be tested for pH, alkalinity, total soluble salts, porosity, extractable sodium content, magnesium, boron, chloride, SAR, nitrate, phosphorus, potassium, organic matter, and soil preparation recommendations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and compliance with all applicable laws.
   2. Deliver all plant blocks with legible identification labels.
   3. State correct plant name and size indicated on plant list.
   4. Use durable waterproof labels with water-resistant ink, which will remain legible for at least 60 calendar days.
   5. Protect plant materials during delivery to prevent damage.
   6. The Contractor shall notify the District Representative 4 calendar days in advance of delivery of all plant materials and shall submit an itemized list of the plants in each delivery.
   7. Storage:
      a. Store plant material in shade and protect from weather.
      b. Maintain and protect plant material in healthy, vigorous condition.

B. Handling: The Contractor shall exercise care in handling, loading, unloading and storing of plant materials. Plant materials that have been damaged in any way shall be discarded and if installed, shall be replaced with undamaged materials at the Contractor's expense.

1.5 PROJECT CONDITIONS

A. Existing Utilities:
   1. Exercise care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by Contractor's operations or neglect. Check existing utility drawings for existing utility locations. Contractor to verify all existing utilities through Dig Alert, at (800) 227-2600 a minimum of 2 days prior to construction.
   2. Repair or replace existing improvements which are not designated for removal which are damaged or removed as a result of Contractor's operations. When a portion of a sprinkler system must be removed, cap the remaining lines. Repairs and replacements shall be equal to existing improvements, and shall match them in finish and dimension.
   3. Protect existing utilities that are not to be removed from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in, as nearly the original condition and location as is reasonably possible.

B. Perform actual planting only when weather and soil conditions are suitable and will not be detrimental to the plant material.

1.6 WARRANTY AND GUARANTIES

A. For Protected Trees during the warranty period: the Contractor shall be liable for damages to all protected trees covered by the provisions of this Section and shall pay compensation to Owner's Authorized Representative.
   1. Contractor shall reimburse Owner's Authorized Representative for loss of protected trees due to damage or lack of care.
   2. For protected trees injured, but not a complete loss to Owner's Authorized Representative, the amount of penalty shall be determined by the Owner's Authorized Representative.

B. All trees 24" box and larger, shall be guaranteed for ~~one~~ two full years. Contractor shall warrant that all plants covered by the provisions of this Section will be in a healthy and flourishing condition of active growth ~~1 year~~ 2 years (typical of all items) from the date of ~~Substantial~~ Final Completion. ***ADD-3***

1. Guarantee boxed trees, to "live and grow" in an "acceptable, upright position after completion of the specified maintenance period and/or final acceptance. Definition of "live and grow" and "acceptable and upright position" shall mean that the tree must, during the guarantee period, sustain a healthy, vigorous appearance. It shall not defoliate more than 30% nor shall 30% of the foliage be dried and unhealthy in appearance. If the tree, during the guarantee period does not sustain this specified appearance, it shall be removed and replaced without cost to the Owner's Authorized Representative.

C. All 15 gallon, 5 gallon, and 1 gallon shrubs and groundcovers shall be guaranteed for ~~6 months~~ 2 years (typical of all items) from date of final acceptance. ***ADD-3***

D. Guarantees after completion of maintenance period and final acceptance will be contingent on the Owner's Authorized Representative's Representative proper continuation of maintenance program.

E. The Contractor, in protecting his own interests, is obligated to periodically check work areas during his guarantee period to insure proper maintenance procedures are being implemented. In case of negligent or improper maintenance, the contractor shall state in writing to the Owner's Authorized Representative his observations and recommendations. Any claims not in writing will not be considered.

F. Should soil deficiencies affecting plant health develop within the specified guarantee periods, correct such deficiencies to the satisfaction of the Owner's Authorized Representative at no additional cost.

1.7 VERIFICATIONS OF DIMENSIONS AND QUANTITIES

A. Verify scaled dimensions and quantities prior to start of work.

B. Notify the District Representative of discrepancies between Drawings and Specifications and actual job site conditions which would affect the execution of the landscaping work. Do not work in areas where discrepancies occur until instructed by the Owner's Authorized Representative.

C. Plant quantities noted on Drawings are for the convenience of the Contractor only and do not limit the Contractor to those specific quantities. Furnish the quantities as may be necessary to do the specific work.

PART 2 PRODUCTS

2.1 IMPORTED SOIL, AMENDMENTS, AND FERTILIZERS

A. The following information on imported soil, soil amendments, fertilizers are to be used for establishing bid prices only. Specific amendments and fertilizer specifications will be made by the soils report after rough grading operations are complete and agronomic soil samples are collected and sent to the Soils lab for testing by the Contractor.

B. Import Top Soil: Silt plus clay content of the Import soil shall not exceed 20% by weight with a minimum 95% passing the 2.0 millimeter sieve. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade. The boron content shall be not greater than 1 part per million as measured on the saturation extract. In order to insure compliance with these specifications, samples of the import soil shall be submitted to an approved laboratory for analysis prior to, and following, backfilling.

C. Soil Amendments: All soil amendments shall be of standard approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis. Provide The Owner's Authorized Representative with a sample of all supplied materials within fourteen (14) days after award of contract, accompanied by analytical data from an approved laboratory source or bearing the manufacturer's guaranteed analysis. Amendments may be modified based on analysis provided.

Soil Amendments:

1. Soil Sulfur: Agricultural grade sulfur containing a minimum of 99% sulfur (expressed as elemental).
2. Iron Sulfate: 20% Iron (expressed as metallic iron), derived from ferric and ferrous sulfate, 10% sulfur (expressed as elemental).
3. Calcium Carbonate Lime: 95% lime as derived from oyster shells.
4. Gypsum: Agricultural grade product containing 98% minimum calcium sulfate.
5. Dolomite Lime:
6. 21% calcium
7. 11% magnesium
8. Nitrogen Fortified Wood Compost: Derived from Redwood, Fir or Cedar sawdust, or from the bark of Fir or Pine treated with a non-toxic agent to absorb water quickly and comply with the following requirements:
   a. Gradation

Sieve Size	Percent Passing
1/4-inch	95% minimum
#8	80% minimum
#35	30% maximum

   b. Nitrogen Content %, Dry Weight

Redwood	0.4 - 0.6%
Fir	0.56 - 0.84%
Cedar	0.56 - 0.84%
Fir Bark	0.8 - 1.2%
Pine Bark	0.8 - 1.2%

9. Salinity: Maximum saturation extract conductivity 2.5 millimhos/centimeter at 25 Celsius degrees.
10. Wettability: When one teaspoon of tap water is applied to 4 cubic inches of the air-dried products, the material shall become completely damp in a period not exceeding 2 minutes. (Greenways Environmental LLC, Pacific Mulch with Growpower, Kellogg KRA, Sequoia Redwood/Cedar blend or white fir, Long Beach soil prep, Bandini #1201 Redwood Soil Builder or nitrogenized wood amendment).

D. Fertilizer:

1. Planting Fertilizer: Pelleted or granular form shall consist of the following percentage by weight and shall be mixed by commercial fertilizer supplier:
   6% nitrogen
   20% phosphoric acid
   20% potash
   38-0-0 slow release organic nitrogen.
2. Commercial product containing 18- 20% available Phosphoric Pentoxide
3. DAP (Di-Ammonium Phosphate): 18-46-0
4. Planting Tablets:
   Shall be slow-released type with potential acidity of not more than 5% by weight containing the following percentages of nutrients by weight:
   20.0% nitrogen
   10.0% phosphoric acid
   5.0% potash
   2.6% combined calcium
   1.6% combined sulfur
   0.35% iron (elemental) from ferrous sulfate

E. Herbicide: Registered and approved by EPA post-emergent herbicide.

2.2 TREE PROTECTION FENCING:

A. Tree Protection Fence: As indicated on drawings.
   1. Install tree protection fencing around trees to be preserved at their drip line or at a minimum of 15' from the tree's trunk. Stands of trees may be fenced as a group. Fencing shall remain until landscape work has commenced, and it shall then be removed as directed by the Owner's Authorized Representative.
   2. During the course of construction, relocation of the fence may be required to facilitate construction. The Contractor shall do so as directed by the Owner's Authorized Representative.

2.3 PLANT MATERIALS:

A. Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery review, rules and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous and free of insect infestations, plant diseases, sunscalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and have well 'hardened' systems and vigorous and fibrous root systems which are not root or pot-bound. In case the sample plants reviewed are found to be defective, The Owner's Authorized Representative reserves the right to reject the entire lot or lots of plants represented by the defective samples. Any plants rendered unsuitable for planting because of this review shall be considered as samples and shall be provided at the expense of the Contractor.

B. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock or as specified on drawings. The minimum acceptable size of all plants measured before pruning with the branches in normal position, shall comply with the measurements, if any, specified on the drawings in the list of plants to be furnished. Plants larger in size than specified may be used with the approval of The Owner's Authorized Representative, but the use of larger plants shall not change the contract price.

C. All plants not in compliance with the requirements herein specified, will be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work and replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size, and conditions specified herein or as shown on the drawings. Under no conditions shall there be any substitutions of plants or sizes listed on the accompanying plans, except with the express consent of The Owner's Authorized Representative.

D. Pruning: At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of The Owner's Authorized Representative.

E. Plant material shall be true to botanical and common name and variety as specified in "Sunset Western Garden Book" (current edition).Nursery Grown and Collected Stock:
   1. Plants shall be grown under climatic conditions similar to those in locality of project.

2.4 TREE STAKING MATERIALS:

A. Wood Tree Stakes for 30" Box and Smaller: Lodge pole pine fully treated with coppernapthanate wood preservative in strict accordance with Federal Spec. TT-W-572 Type 1 Composition B, 2" min. nominal size diameter x 10' long, no split stakes.

B. Tree Tie are to be VIT Twist Brace Tree Supports or approved equal, Two (2) per tree. TB24 Twist Brace for 15 gal.-24 inch box. Large size tree boxes per manufacturer recommendations. Install per Construction document detail.

C. Tree Root Barriers are to be #UB 48-2 Universal Barrier available from Deep Root Partners L.P. or approved equal.

2.5 PLANTER DRAINAGE GRAVEL

A. Drainage gravel is to be ¾" crushed gravel.

2.6 LANDSCAPE FABRIC

A. Weed barrier installed in all planters per Campus standards. Composite fabric Marafi 140N or District APPROVED EQUAL.

2.7 MULCH

A. Mulch shall be shredded redwood mulch.
   1. A minimum of 4 inch layer of mulch is to be installed throughout all planters per Campus Standards under all trees, shrubs and groundcover areas.
      a. Keep a mulch ring 6 inches clear around all tree trunks and 3 inches clear around the central leader stem of each shrub.
   2. Type: “Forest Floor ½ inch – 1 ½ inch or approved equal. The mulch shall consist of moist, fibrous, woody redwood bark mixture of varied particle size such that: Physical Properties: Particle Size ½ inch- 1 ½ inch.
   3. Mulch is available from: Aguinaga Sales and Research Division
      16355 Construction Circle West, Irvine CA 9260
      www.aguinagagreen.com

B. Header shall be a steel edging, size 2” x 4” sections with stake at every 36" along the section; 12" long plastic stakes.
   1. Headers shall be furnished as shown on the drawings and herein specified. They shall be laid true to line and grade and in a workmanlike manner. Care shall be exercised in laying headers to project adjacent improvements, shrubbery and other properties from damage. All stakes shall be placed on ground cover side of headers. Install per plan and details.

C. Stabilized Decomposed Granite Gravel Mulch shall be rock particles placed in two layers as shown on the plans and as specified herein.
   1. Gravel mulch shall be crushed rock or decomposed granite, color per plan.
   2. Gravel mulch shall consist of fine materials, obtained from a single source and shall be approved for use by the Owner’s Authorized Representative.
   3. Crush Rock or Decomposed Granite shall conform to the following grading:

Screen Size	Percentage Passing (By Mass)
9.5 Millimeters	100
4.75 Millimeters	85-95
2.36 Millimeters	65-80
1.18 Millimeters	20-60
150 Micrometers	5-15

   4. Gravel mulch available from South West Boulder and Stone
   5. Stabilizer shall be integrated into Decomposed Granite by manufacture and installed per manufacturer’s recommendations.

D. Boulders type/color and size per Construction Legend.
   1. Boulders available from South West Boulder and Stone

PART 3 EXECUTION

3.1 PROTECTION OF TREES

A. Arborist shall identify the trees that must be protected.

B. Water: Provide sufficient water supply of potable quality and sufficient quantity for all operations required under this section. Water quantity to be carefully monitored during construction to maintain the health and vigor of the tree.

C. The existing trees to be preserved presently are in excellent condition. Trees shall not be allowed to deteriorate and shall be maintained in a healthy and vigorous condition during the course of construction and maintenance period.

D. During the course of construction the Contractor shall take all necessary precautions, as outlined herein, to protect the existing trees to be preserved from injury or death. Protection shall be given to the roots, trunk, and foliage of all existing trees to remain.

E. Trees subject to the provisions of this Section which have been injured shall be repaired immediately under the supervision of an approved, certified arborist. Repair may include removal of rough edges and sprung bark and severely injured branches as directed by the Owner's Authorized Representative.

F. Tree protection fencing shall be installed for the protection of existing trees to be preserved. No construction, demolition, or work of any nature will be allowed within the fenced area without prior written approval by the Owner's Authorized Representative.

1. Approval by the Owner's Authorized Representative for work within the fenced area shall not release the Contractor from any of the provisions specified herein for the protection of existing trees to be preserved.
2. During the course of construction of approved work within the fenced area, no roots larger than two (2) inches in diameter shall be cut without prior written approval by the Owner's Authorized Representative.

G. During construction the existing site surface drainage patterns shall not be altered within the area of drip line or in compliance with the development plans.

H. Contractor shall not alter the existing water table within area of drip line during rough grading unless directed by Owner's Authorized Representative.

I. Take necessary measures to maintain healthy living conditions for existing trees to be preserved. Such measures shall include but not be limited to periodic washing of leaves for the removal of dust, etc.

J. Do not permit the following within the drip line of any existing tree to be preserved:

1. Storage or parking of automobiles or other vehicles.
2. Stockpiling of building materials or refuse of excavated materials.
3. Skinning or bruising of bark.
4. Use of trees as support posts, power poles, or signposts; anchorage for ropes, guy wires, or power lines; or other similar functions.
5. Dumping of poisonous materials on or around trees and roots. Such material include but are not limited to paint, petroleum products, dirty water, concrete slurry, or other deleterious materials.
6. Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches, and other miscellaneous excavation without prior written approval by Owner's Authorized Representative.
7. Damage to trunk, limbs, or foliage caused by maneuvering vehicles or stacking material or equipment too close to tree.
8. Compaction of the root area by movement of trucks or grading machines; storage equipment, gravel, earth fill, or construction supplies, etc.
9. Excessive water or heat from equipment, utility line construction, or burning of trash under or near shrubs or trees.
10. Damage to root system from flooding, erosion, and excessive wetting and drying resulting from dewatering and other operations.

K. Excavation Around Trees

1. Excavation or fill within drip lines of trees shall be done only where absolutely necessary and with the direction of the Arborist.
2. Where trenching for utilities is required within drip lines, it shall be under the supervision and direction of the Arborist. Trenching within a tree's dripline area may require the use of hand tools.
3. Where excavation for new construction is required within drip line of trees, hand excavation under the supervision of the Arborist may be required to minimize damage to root system. Damaged roots or roots requiring removal that are larger than 2" diameter shall be cleanly cut by a hand saw. Cuts shall be made back to healthy root tissue.

4. Exposed roots and soil areas shall not be allowed to dry out before permanent backfill is placed. Temporary earth cover or organic mulch shall be provided, or roots shall be packed with wet peat moss or four layers of wet, untreated burlap and temporarily supported and protected from damage until permanently covered with backfill. The cover over the roots shall be wetted to the point of runoff daily.
5. Pruning may be required to balance loss to root system caused by damage or cutting of root system. Thinning shall not exceed 30 percent of existing foliage and shall be directed by the Owner's Authorized Representative.
6. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

L. Pruning of Protected Tree

1. Trees which require pruning shall be inspected by Arborist, Owner's Authorized Representative and the Contractor before starting this work. All Pruning shall be in accordance with the standards of the International Society of Arboriculture or as directed by the Owner's Authorized Representative. All pruning shall be directed under the supervision of the Arborist.
2. The Owner's Authorized Representative and the Contractor's arborist will identify limbs and roots which are to be trimmed.
3. The Owner's Authorized Representative shall direct the removal of branches from trees and large shrubs which are to remain if required to clear for new construction.
4. Dead and damaged trees that are determined by the Owner's Authorized Representative and Arborist to be incapable of restoration to normal growth pattern shall be removed.
5. Cut evenly, using proper tools and skilled workmen, to achieve neat severance with the least possible damage to the tree.
6. In the case of root cuts, apply wet burlap or other protection, approved as noted herein, to prevent drying out, and maintain stem in a wet condition as long as necessary for temporary protection.

3.2 EXAMINATION

A. Review trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning. Planting areas shall be free of concrete waste, asphalt, aggregate or other construction materials prior to start of installation.

B. All trees brought to the site shall first be inspected by an arborist for insect infestation. ***ADD-3***

C. Do not begin planting of trees until deficiencies are corrected or plants replaced.

D. Site Visits:

1. Site visits for review and review of work shall be scheduled with the Owner's Authorized Representative, and shall include, but not be limited to the following times:
   a. Review and test irrigation system.
   b. Review of fine grading operation, including planting areas and swales.
   c. Review of planting stock upon arrival to site or at nursery. Review of plant material placement for location prior to planting.
   d. Review of completed grading, irrigation and planting.
   e. Review at the completion of the maintenance period.
   f. Review at the completion of the warranty period.

3.3 PREPARATION

A. Soil Preparation (on grade areas):

1. If live weeds exist on site, strip and remove and replace top 1" of soil.
2. After approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Soil should be slightly damp, but not muddy during rototilling.
   a. Prior to amending, the surface soil shall be cross ripped to a minimum nine (9) inch depth.
   b. The following shall be used for bidding purposes only. The contractor shall verify with the soil report prepared for the site specific amendments.
   c. Uniformly broadcast and blend to a six (6) inch depth:
      1) Organic amendment - 6 cu. yds.
      2) Planting fertilizer - 15 lbs.

3) Agricultural gypsum - 200 lbs.
4) Soil sulfur - 20 lbs.
5) Urea formaldehyde - 8 lbs.

3. At time of planting, the top two inches of all areas to be planted shall be free of stones, stumps, earth clods, or other deleterious matter 1" in diameter or larger, and shall be free from all plastic, wire, plaster, obvious foreign matter or similar objects that would be a hindrance to planting or maintenance. The top 12" of soil shall be free of all stones, stumps or other deleterious matter 3" in diameter or larger.

B. Final Grades:

1. Bring soil to grades as indicated on drawings, importing soils as necessary and anticipating the installation of soil amenders and settling and/or compaction.
2. Finish grading shall insure proper drainage of the site as determined by the Owner's Authorized Representative
3. .All areas shall be graded so that the final grades will be 1" below adjacent paved areas, sidewalks, valve boxes, headers, tree well grates, planter rims, clean-outs, drains, manholes, etc., or as indicated on plans for turf, and 1-1/2" for shrubs and ground covers.
4. Surface drainage shall be away from all building foundations.
5. Eliminate all erosion scars prior to commencing maintenance period.
6. Compact all soil to final grades: min. 65%, max. 75%, unless otherwise required by soils report or direction from The Owner's Authorized Representative.

C. Disposal of Excess Soil: Dispose of any unacceptable or excess soil at an off-site location approved by the Owner's Authorized Representative.

3.4 INSTALLATION

A. General:

1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice as approved by the Owner's Authorized Representative.
2. Only as many plants as can be planted on that same day shall be distributed in a planting area. All plants shall be watered within 2 hours of planting.
3. Containers shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Pre-Plant Weed Control:

1. After soil preparation, irrigate and fertilize all planting areas for approximately 7-14 calendar days to achieve weed germination.
2. If live weeds exist on site after irrigating and at the beginning of work, spray with a non-selective systemic contact herbicide, as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.
3. Clear and remove all weeds by grubbing off all plant parts at least 1/4" below the surface of the soil to be planted.
4. Repeat process as necessary, or as directed by the Owner's Authorized Representative. Do not plant until herbicide manufacturer indicates planting will not be affected by herbicide residue.
5. Maintain site weed-free at all times. Degree of acceptability shall be solely determined by Owner's Authorized Representative.

C. Lay-Out of Major Plantings: Locations for container plants shall be spotted and outlines of ground cover areas to be planted shall be marked on the ground before any planting or excavation begins. All such locations shall be approved by The Owner's Authorized Representative. Layout shall be accomplished by setting container plants or grade stakes with plants identified in locations indicated on plans, and with gypsum lines for ground cover areas. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting will be selected as approved by the Owner's Authorized Representative.

D. Planting of Trees and Shrubs:
   1. Excavate planting pits at twice the diameter of rootball with roughened surfaces and one and one half times the depth.
   2. Prior to planting trees, fill planting hole with water to see if water drains in a reasonable time (approximately 4 hours). If drainage does not occur to the satisfaction of the District Representative, auger a 24 inch diameter hole, to a depth 12 inches above the water table but not exceeding 12 feet deep and fill with sand. Do not penetrate water table with drain hole.
   3. The top of the rootball should be slightly above final grade.
   4. Uniformly blend 2 lbs. of iron sulfate and 1/2 lb. planting fertilizer per cubic yard of backfill soil.
   5. Organic material is not required in the backfill. A soil blend consisting of no more than 20% by volume organic matter shall be placed in the upper twelve (12) inches of backfill only. Soil below this depth shall not contain any organic matter.
   6. Place slow release fertilizer tablets in the upper twelve (12) inches of backfill at manufacturers recommended rates.
   7. Construct a two (2") inch water berm on the outside edge of rootball.
   8. Cover the rootball with mulch.
   9. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.
   10. Install root barriers, as specified on plans
   11. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Cross rip all compacted areas to a 9 inch minimum depth except where existing tree roots of trees that are to remain as part of this work are evident.
   12. Center plant in pit or trench.
   13. Face plants with fullest growth into prevailing wind or as directed by The Owner's Authorized Representative.
   14. Set plant plumb and hold rigidly in position until soil has been placed firmly around ball or roots.
   15. All plants which settle deeper than the surrounding grade shall be raised to the correct level.
   16. Box Removal: Remove bottom of plant boxes before planting. Remove sides of box without damage to rootball after positioning plant and partially backfilling.
   17. Pruning: Pruning shall be limited to the minimum necessary to remove injured twigs and branches. Pruning may not be done prior to delivery of plants.
   18. Staking: Staking of trees as directed by The Owner's Authorized Representative shall be completed immediately after planting. All stakes shall be installed plumb and as indicated on the Drawings per prevailing wind.

E. Planting of Groundcovers:
   1. Groundcover shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the drawings. Triangular spacing shall be used unless otherwise noted on the drawings.
   2. Plantings shall be immediately sprinkled after planting until the entire area is soaked to the full depth of each hole.
   3. Care shall be exercised at all times to protect the plants after planting. Any damage to plants by trampling or other operations of this Contract shall be repaired immediately.

F. Mulch Cover: All groundcover, perennial, and annual beds to be dressed with 3" deep layer of mulch, (unless otherwise noted on plan.)

3.5 CLEANING

A. Leave the site area broom-clean daily leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.

B. After all planting operations have been completed, remove all trash, excess soil, empty plant containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. Pick up all trash resulting from this work no less frequently than each Friday before leaving the site or the last working day of each week. All trash shall be removed completely from the site.

3.6 SCHEDULES

A. When observations are conducted by someone other than The Owner's Authorized Representative, show evidence in writing of when and by whom these observations were made.

B. No site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by The Owner's Authorized Representative. Failure to accomplish punch list tasks or prepare adequately for desired observations shall make the Contractor responsible for reimbursing The Owner's Authorized Representative at his current billing rates per hour (plus transportation costs No further observations shall be scheduled until this charge has been paid and received.

END OF SECTION

SECTION 329700
LANDSCAPE MAINTENANCE

Revised, Addendum # 3, 09/22/2017

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish all labor, material, equipment and services required to maintain the landscape in an attractive condition as specified herein for a period of 90 calendar days. Contractor's bid shall include all materials and services referenced in the Drawings and these Specifications, and shall be responsible for review and completion all these specification instructions herein.

B. Related Sections:

1. Section 129300 - Site Furnishings
2. Section 321400 - Unit Paving
3. Section 328400 - Irrigation Systems
4. Section 329000 - Planting

1.2 SUBMITTALS

A. Submittals for review during construction phase:

1. Catalog cuts of all herbicides and fertilizers.
2. Prior to being placed on maintenance, submit a schedule of all activities planned during the maintenance period. This shall be accepted by the Owner's Authorized Representative prior to the start of the maintenance period. All schedule changes shall be documented and accepted by the College Representative.
3. The field set of "As-Built" drawings shall be available for review at the beginning of maintenance site walk
4. Prior to date of the final walk-through, the Contractor shall acquire from the Owner's Authorized Representative a set of approved reproducible prints and produce the final record from the job record set of all changes made to all plans during construction, label said prints "As-Builts" and deliver to the College Representative, and as required to any Local Agency. Prior to the date of final inspection, deliver to the Owner's Authorized Representative the "Landscape and Irrigation Warranty" as required. Said Warranty shall be on the Contractor's letterhead and dated the scheduled final acceptance date.
5. All turnover items noted in other specification sections shall be delivered prior to the final walk-through.
6. Supply a monthly record of all herbicides, insecticides, fertilizers, and disease control chemicals with rates and amounts used noted.
7. Soils Report may adjust fertilizer rates and frequencies as noted herein.

1.3 QUALITY ASSURANCE

A. Installer Qualifications

1. Experience: The landscape establishment firm shall have a full time foreman assigned to the job for the duration of the contract. That person shall have a minimum of four (4) years' experience in landscape establishment and maintenance supervision, with experience or training in tree maintenance, entomology, pest control, soils, fertilizers, and plant identification.
2. Labor Force: The landscape establishment firm's labor force shall be thoroughly familiar and trained in the work to be accomplished and perform the task in a competent, efficient manner acceptable to the Owner's Authorized Representative.
3. Supervision: The foreman shall directly employ and supervise the work force at all times. Notify The Owner's Authorized Representative of all changes in supervision.

4. Identification: Provide proper identification at all times for landscape establishments firm's labor force. Be uniformly dressed in a manner satisfactory to the Owner's Authorized Representative.
5. The Owner's Authorized Representative shall have the right to make periodic inspections prior to final inspection. Should plant materials, installation procedures, or other conditions be observed that are not in accordance with the contract drawings or specifications, the Owner's Authorized Representative shall direct the Contractor to correct by repair and /or replacement as appropriate. The Owner's Authorized Representative shall be the sole judge of the conditions of quality and acceptability and will direct all corrections by the Contractor. All rejected materials shall be immediately removed from the site and replaced with specified materials at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials used shall either comply with the Landscape Planting Specifications or shall otherwise be acceptable to the Owner's Authorized Representative.

B. Maintenance Fertilizer shall consist of the following percentages by weight and shall be mixed by a commercial fertilizer supplier unless otherwise directed by The Owner's Authorized Representative or as specified agronomic soils report prepared by District's ~~Wallace~~ Labs, ~~dated 6/16/2011 and any subsequent soils tests performed.~~ Refer to Planting Specification 329000 for Site Soil Quality information. ***ADD-3***

PART 3 EXECUTION

3.1 APPLICATION

A. Tree and Shrub
   1. Watering: Maintain a large enough water basin around plants so that enough water can be applied to establish moisture through the major root zone. When hand-watering, use a water wand to break the water force.
   2. Staking: Remove stakes as soon as they are no longer needed. Stakes are to be inspected to prevent girdling of trunks or branches and to prevent rubbing that causes bark wounds. Replace all broken stakes and ties with specified materials.
   3. Weed Control: Keep basins and areas between plants free of weeds. Use recommended legally approved herbicides. Avoid frequent soil cultivation that destroys shallow roots. Use mulches to help prevent weed seed germination. All shrub and tree beds shall be kept weed-free.
   4. Insect and Disease Control: Maintain reasonable control with approved materials.
   5. Tighten all tree ties and guying as needed to keep trees growing in a straight upright position.

B. Fertilization:
   1. Fertilize all planting areas per recommendations listed in the agronomic soils report prepared by District's ~~Wallace~~ Labs, ~~dated 6/16/2011~~ and any subsequent soils tests performed. ***ADD-3***
   2. After application, irrigate thoroughly.
   3. Avoid applying fertilizer to the root ball and base of main stem: rather, spread evenly under plant to drip line.

C. Replacement of Plants:
   1. Replace dead, dying and missing plants within one (1) week with plants of a size, condition and variety acceptable to the Owner's Authorized Representative at Contractor's expense.

D. Ground Cover Care:
   1. Weed Control: Control weeds with chemical systemic spray or by hand or mechanical means, so as to cause minimal damage to planted materials. All planted areas shall be kept trash and weed-free.
   2. Watering: Water enough so that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth. Do not over water.

3. Fertilizing: Fertilize as specified agronomic soils report prepared by District's ~~Wallace~~ Labs, ~~dated 6/16/2011~~ and any subsequent soils tests performed. ***ADD-3***
4. Remove trash weekly.
5. Edge ground cover to keep in bounds and trim top growth as necessary to achieve an overall even appearance, unless directed by the Owner's Authorized Representative.
6. Repair all settlement conditions.

E. Irrigation System Care:

1. Check weekly all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each end of the lateral. All heads are to be adjusted as necessary for unimpeded coverage. Tree Bubblers and Low Flow Irrigation Systems shall be checked for clogging and flushed as needed per manufacturers recommendations.
2. Repair all damage to irrigation systems at the Contractor's expense. Repairs shall be made within one watering period.

3.2 ADJUSTING, CLEANING, AND PROTECTION

A. All areas shall be kept free of debris and all planted areas shall be weeded and cultivated at intervals of not more than ten (10) calendar days. Watering, mowing, rolling, edging, trimming, fertilization, spraying and pest control, as may be required, shall be included within the debris/siltation removal program. All area drains and drain pipes are to remain free of silt and debris.

B. The Contractor shall be responsible for maintaining adequate protection of the area. Damaged areas shall be repaired at the Contractor expense.

C. Between the 15th calendar day and the 20th calendar day of the maintenance period, replant all areas within the landscape that are not in vigorous, healthy conditions is not evident as determined by the Owner's Authorized Representative. Replenish any mulch areas not acceptable to the Owner's Authorized Representative to the depth noted on the plans.

END OF SECTION

GENERAL NOTES:

1. WORK SHOWN HEREON SHALL BE DONE IN ACCORDANCE WITH THE "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION", LATEST EDITION AND SUPPLEMENTS.
2. ALL GRADING WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS AND RECOMMENDATIONS CONTAINED IN THE GEOTECHNICAL REPORT, "GEOTECHNICAL ENGINEERING REPORT", BY TERRACON CONSULTANTS DATED JUNE 27, 2016 AND ADDENDUM NO. 1 DATED MAY 24, 2017.
3. EXISTING TOPOGRAPHY SHOWN HEREON WAS TAKEN FROM A SURVEY DATED SEPTEMBER 26, 2016 BY PENCO ENGINEERING, INC.
4. THE CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR THE JOB SITE CONDITIONS, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY, AND SHALL NOT BE LIMITED TO NORMAL WORKING HOURS.
5. PRIOR TO COMMENCING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY ALL JOIN CONDITIONS FOR GRADING, DRAINAGE AND UNDERGROUND FACILITIES INCLUDING LOCATION AND ELEVATION OF EXISTING UNDERGROUND FACILITIES AT CROSSINGS WITH PROPOSED UNDERGROUND FACILITIES. IF CONDITIONS DIFFER FROM THOSE SHOWN ON THE PLANS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND SHALL NOT BEGIN CONSTRUCTION UNTIL THE CHANGED CONDITIONS HAVE BEEN EVALUATED.
6. ALL DRAWINGS ARE CONSIDERED TO BE A PART OF THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REVIEW AND COORDINATION OF ALL DRAWINGS AND SPECIFICATIONS PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCIES THAT OCCUR SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT PRIOR TO THE START OF CONSTRUCTION SO THAT A CLARIFICATION CAN BE ISSUED. ANY WORK PERFORMED IN CONFLICT WITH THE CONTRACT DOCUMENTS OR ANY CODE REQUIREMENTS SHALL BE CORRECTED BY THE CONTRACTOR AT THEIR OWN EXPENSE AND AT NO EXPENSE TO THE OWNER OR ARCHITECT.
7. THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.
8. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS. WHERE NO DETAILS ARE GIVEN, CONSTRUCTION SHALL BE AS SHOWN FOR SIMILAR WORK.
9. THE EXISTENCE, LOCATION AND CHARACTERISTICS OF UNDERGROUND UTILITY INFORMATION SHOWN ON THESE PLANS HAVE BEEN OBTAINED FROM A REVIEW OF AVAILABLE RECORD DATA. NO REPRESENTATION IS MADE AS TO THE ACCURACY OR COMPLETENESS OF SAID UTILITY INFORMATION. THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN AND ANY OTHER LINES NOT OF RECORD OR NOT SHOWN ON THESE PLANS.
10. IF AT ANY TIME DURING GRADING OPERATIONS, ANY UNFAVORABLE GEOLOGICAL CONDITIONS ARE ENCOUNTERED, GRADING IN THAT AREA WILL STOP UNTIL APPROVED CORRECTIVE MEASURES ARE OBTAINED.
11. THE PROPOSED GRADE IS THE FINAL GRADE AND NOT THE ROUGH GRADE. THE CONTRACTOR SHALL SUBTRACT THE THICKNESS OF THE PAVED SECTION AND/OR LANDSCAPE TOPSOIL SECTION TO ARRIVE AT THE ROUGH GRADE ELEVATION.
12. STRAIGHT GRADE SHALL BE MAINTAINED BETWEEN CONTOUR LINES AND SPOT ELEVATIONS UNLESS OTHERWISE SHOWN ON THE PLANS.
13. ALL DEBRIS AND FOREIGN MATERIAL SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT APPROVED DISPOSAL SITES. THE CONTRACTOR SHALL OBTAIN NECESSARY PERMITS FOR THE TRANSPORTATION OF MATERIAL TO AND FROM THE SITE.
14. ALL FILL SOILS OR SOILS DISTURBED OR OVEREXCAVATED DURING CONSTRUCTION SHALL BE COMPACTED PER THE REQUIREMENTS OF THE SOILS REPORT BUT NOT LESS THAN 90% MAXIMUM DENSITY AS DETERMINED BY A.S.T.M. SOIL COMPACTION TEST D-1557.
15. THE CONTRACTOR SHALL OBTAIN AN O.S.H.A. PERMIT FROM THE CALIFORNIA DIVISION OF INDUSTRIAL SAFETY PRIOR TO THE CONSTRUCTION OF TRENCHES OR EXCAVATIONS WHICH ARE FIVE FEET OR DEEPER.
16. DIMENSIONS TO PIPELINES ARE TO CENTERLINE UNLESS OTHERWISE NOTED.
17. ALL WATER LINES SHALL BE INSTALLED WITH 36" MINIMUM COVER FROM TOP OF PIPE TO FINISHED GRADE, UNLESS OTHERWISE NOTED.
18. THRUST BLOCKS SHALL BE INSTALLED AT WATERLINE HORIZONTAL AND VERTICAL BENDS, TEES, CAPPED ENDS AND REDUCERS ACCORDING TO THE DETAILS PROVIDED ON THESE PLANS.
19. CONSTRUCTION STAKING FOR IMPROVEMENTS SHOWN ON THESE PLANS SHALL BE PERFORMED BY A LICENSED LAND SURVEYOR.
20. THE CONTRACTOR SHALL REPLACE ALL EXISTING IMPROVEMENTS DAMAGED DURING CONSTRUCTION TO MATCH EXISTING, INCLUDING PERMANENT TRENCH RESURFACING.
21. CONTRACTOR TO CONTACT UNDERGROUND SERVICE ALERT (800-227-2600) PRIOR TO EXCAVATION.
22. ALL DIMENSIONS ARE IN FEET OR DECIMALS THEREOF.
23. ALL CURB DIMENSIONS AND RADII ARE TO PAVEMENT FACE OF CURB.
24. CONTRACTOR TO BE AWARE OF ALL OVERHEAD LINES AT ALL TIMES, SO AS NOT TO DISTURB THEM.
25. WATER SHALL BE PROVIDED ONSITE AND USED TO CONTROL DUST DURING CONSTRUCTION OPERATIONS.
26. CONTRACTOR SHALL OBTAIN ANY NECESSARY PERMITS FROM THE CITY OF SANTA ANA ANY LOCAL UTILITY PURVEYOR REQUIRED FOR ALL WORK WITHIN THE PUBLIC RIGHT-OF-WAY.
27. STORM DRAINAGE SYSTEMS SHOWN ON THESE PLANS HAVE BEEN DESIGNED FOR THE FINAL SITE CONDITION AT COMPLETION OF THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ADEQUATE DRAINAGE OF THE SITE, DURING INTERIM CONDITIONS OF CONSTRUCTION.
28. CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS, INCLUDING NPDES, FROM THE APPROPRIATE JURISDICTIONAL AGENCIES FOR DISCHARGE OF GROUNDWATER THAT MAY BE NECESSARY TO ACCOMPLISH EXCAVATIONS SHOWN ON THESE PLANS.

LEGEND:

GENERAL

- CIVIL LIMITS OF WORK
- SHEET MATCH LINE

ANNOTATION

- 100.00 XX — SURFACE ELEVATION/UTILITY ELEVATION
- (100.00 XX) — EXISTING SURFACE ELEVATION/UTILITY ELEVATION
- XX — CONSTRUCTION NOTE
- 2.0% — FLOW (DIRECTION AND GRADE)
- 2:1 — SLOPE (DIRECTION AND RUN:RISE)
- XX — HORIZONTAL CONTROL POINT LABEL
- CX — CURVE DATA LABEL
- FF=100.00 — PAD/FINISHED FLOOR ELEVATION

SITE

- CURB/BACK OF CURB/GUTTER
- PROPERTY LINE/RIGHT OF WAY
- CENTER LINE
- X — FENCE
- TO BE DEMOLISHED
- SITE WALL (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
- CONCRETE SEAT WALL (REFER TO LANDSCAPING PLANS FOR DETAILS)

EROSION CONTROL

- SANDBAGS
- FIBER ROLL
- PROPOSED BUILDING EXCAVATION OUTLINE
- EXISTING DRAINAGE DIRECTION OF FLOW
- PROTECT TREE IN PLACE

GRADING

- 100 — PROPOSED MAJOR CONTOUR
- 102 — PROPOSED MINOR CONTOUR
- FLOW LINE
- GB — GRADE BREAK LINE
- R — RIDGE LINE
- EARTHEN SWALE
- SAWCUT
- LIMITS OF GRADING
- GRADING BENCH
- TOP / TOE — GRADED SLOPE (HORIZONTAL:VERTICAL)

UTILITY

- SS — SANITARY SEWER
- W — WATER
- DW — DOMESTIC WATER
- FW — FIRE WATER
- SD — STORM DRAIN
- G — GAS
- E — ELECTRIC
- T — TELEPHONE
- PERFORATED PIPE
- POINT OF CONNECTION
- COORDINATION POINT
- CAP OR PLUG
- UTILITY MANHOLE
- UTILITY CLEANOUT
- STORM DRAIN INLET
- AREA DRAIN/PLANTER DRAIN
- TRENCH DRAIN
- FIRE HYDRANT
- THRUST BLOCK
- FIRE DEPARTMENT CONNECTION (FDC)
- POST INDICATOR VALVE (PIV)
- WATER VALVE
- BACKFLOW ASSEMBLY
- UTILITY METER VAULT

ABBREVIATIONS:

AC	ASPHALTIC CONCRETE	MH	MANHOLE
BCR	BEGIN CURVE RETURN	(N)	NORTH
BW	BACK OF WALK	NTS	NOT TO SCALE
BLDG	BUILDING	PA	PLANTER AREA
BM	BENCH MARK	POC	POINT OF CONNECTION
BOS	BOTTOM OF STAIRS	PIV	POST INDICATOR VALVE
BMP	BEST MANAGEMENT PRACTICES	PCC	POINT OF COMPOUND CURVE
CB	CATCH BASIN	PRC	POINT OF REVERSE CURVE
CI	CAST IRON	PRV	PRESSURE REDUCING VALVE
CL	CENTER LINE	PVC	POLYVINYL CHLORIDE
CMU	CONCRETE MASONRY UNIT	R	RADIUS
CO	CLEANOUT	RCIP	RECTANGULAR CAST IRON PIPE
CONC	PORTLAND CEMENT CONCRETE	RD	ROOF DRAIN
CF	CURB FACE	RW	RIGHT-OF-WAY
DW	DOMESTIC WATER	(S)	SOUTH
(E)	EAST	S=	SLOPE EQUALS
ECR	END CURVE RETURN	SD	STORM DRAIN
EG	EDGE OF GUTTER	SSMH	SANITARY SEWER MANHOLE
EL. OR ELEV	ELEVATION	SS	SANITARY SEWER
ELEC	ELECTRIC, ELECTRICAL	STD	STANDARD
EX. OR EXIST.	EXISTING	SDMH	STORM DRAIN MANHOLE
FDC	FIRE DEPARTMENT CONNECTION	TC	TOP OF CURB
FF	FINISHED FLOOR	TEL	TELEPHONE
FG	FINISHED GRADE (LANDSCAPE)	TG	TOP OF GRATE
FS	FINISHED SURFACE (HARDSCAPE)	TOS	TOP OF STAIRS
FH	FIRE HYDRANT	TW	TOP OF WALL
FL	FLOW LINE	TS	TRAFFIC SIGNAL
FT	FOOT OR FEET	TSB	TRAFFIC SIGNAL BOX
FU	FIXTURE UNITS	TYP	TYPICAL
FW	FIRE WATER	TV	TELEVISION
GPM	GALLONS PER MINUTE	VIF	VERIFY IN FIELD
GV	GATE VALVE	VLT	VAULT
HDPE	HIGH DENSITY POLYETHYLENE	VCP	VITRIFIED CLAY PIPE
HP	HIGH POINT	(W)	WEST
INV.	INVERT	W	WATER
LP	LOW POINT	WM	WATER METER
MAX.	MAXIMUM	WV	WATER VALVE
MIN.	MINIMUM		

PATTERN LEGEND

- CONCRETE PAVING (REFER TO SHEET C5.00 FOR DETAILS)
- VEHICULAR CONCRETE PAVING (REFER TO SHEET C5.00 FOR DETAILS)
- ASPHALT (REFER TO SHEET C5.00 FOR DETAILS)
- HEAVY DUTY ASPHALT (REFER TO SHEET C5.00 FOR DETAILS)
- LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
- LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
- BRICK PAVERS (REFER TO LANDSCAPING PLANS FOR DETAILS)

BENCHMARK (PER PENCO'S SURVEY):

COUNTY OF ORANGE BENCHMARK NO. SA-318-84

FOUND 3-3/4" OCS ALUMINUM BENCHMARK DISK STAMPED "SA-318-84" SET IN THE SOUTHWEST CORNER OF A 6FT. BY 4FT. CONCRETE CATCH BASIN. MONUMENT IS LOCATED AT THE NORTHEAST CORNER OF THE INTERSECTION OF BRISTOL STREET AND WASHINGTON, 57TH. NORTHERLY OF THE CENTERLINE OF WASHINGTON AND 30FT. EASTERLY OF THE CENTERLINE OF BRISTOL STREET 0.7" SOUTHEASTERLY OF A 24" STEEL STORM DRAIN LID. MONUMENT IS LEVEL WITH SIDEWALK.

ELEVATION = 108.453'
NAVD 88 LEVELED 1992

BASIS OF BEARINGS (PER PENCO'S SURVEY):

FOR THE PURPOSE OF THIS PROJECT, BEARINGS ARE BASED ON ORANGE COUNTY GPS CONTROL NETWORK (NAD88), ZONE 6 20007.00 EPOCH

SHEET INDEX:

CIVIL DRAWINGS	
C0.01	TITLE SHEET
C1.00	SURVEY (FOR REFERENCE ONLY)
C1.01	SURVEY (FOR REFERENCE ONLY)
C1.10	DEMOLITION PLAN
C1.20	EROSION CONTROL PLAN
C1.30	ROUGH GRADING PLAN
C1.31	ROUGH GRADING SECTIONS
C1.32	GRADING PLAN INDEX
C1.33	GRADING PLAN
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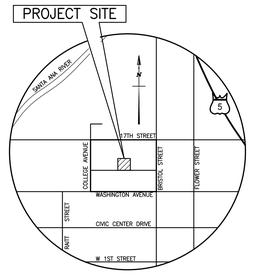
C1.35	GRADING PLAN
C1.40	STORM DRAINAGE PLAN
C1.50	UTILITY PLAN
C1.51	UTILITY PLAN ENLARGEMENT
C1.52	STORM DRAIN PROFILES
C1.53	STORM DRAIN PROFILES
C1.54	SEWER PROFILES & UTILITY SECTIONS
C1.55	UTILITY SECTIONS
C1.60	PAVING PLAN
C1.70	FIRE HYDRANTS AND ACCESS PLAN
C5.00	CIVIL DETAILS
C5.01	CIVIL DETAILS
C5.02	CIVIL DETAILS
C5.03	CIVIL DETAILS



VICINITY MAP
NOT TO SCALE

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF SOILS ENGINEERING/GEOLOGICAL REPORT BY TERRACON CONSULTANTS DATED JUNE 27, 2016.

SIGNATURE _____ DATE _____ STAMP

1-800-227-2600
CALL USA/SC FOR UNDERGROUND LOCATING 48 HOURS BEFORE YOU DIG!

IMPORTANT NOTICE
SECTION 4216/4217 OF THE GOVERNMENT CODE REQUIRES A DIGALERT IDENTIFICATION NUMBER BE ISSUED BEFORE A "PERMIT TO EXCAVATE" WILL BE VALID. FOR YOUR DIGALERT I.D. NUMBER CALL UNDERGROUND SERVICE ALERT TOLL FREE 1-800-227-2600 TWO WORKING DAYS BEFORE YOU DIG

hga.
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 S. FLOWER ST., #2100
LOS ANGELES, CA 90017
213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE

RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF CALIFORNIA.

NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

TITLE SHEET

DATE: JULY 06, 2017

C0.01

ADDENDA PACKAGE

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P:\2014\114225 Santa Ana College STEM Project\DWG\SHEET\114225-C0.01GN.dwg, Sep 20, 2017 - 10:12pm

GENERAL DEMOLITION NOTES:

1. CONTRACTOR TO CLEAR PROJECT SITE AREA WITHIN THE CONFINES OF THE DEMOLITION LIMIT LINE. THE CONTRACTOR SHALL DEMOLISH AND REMOVE FROM THE SITE ALL EXISTING UTILITIES, STRUCTURES, PLANTERS, TREES, AND ALL OTHER SITE FEATURES, UNLESS OTHERWISE NOTED ON THE PLAN.
2. REMOVAL OF LANDSCAPING SHALL INCLUDE ROOTS AND ORGANIC MATERIALS.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ANY AND ALL PERMITS AND SHALL PAY ALL FEES NECESSARY FOR ENCROACHMENT, GRADING, DEMOLITION AND DISPOSAL OF SAID MATERIALS AS REQUIRED BY PRIVATE, LOCAL AND STATE JURISDICTIONS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR A SITE INSPECTION TO FULLY ACKNOWLEDGE THE EXTENT OF THE DEMOLITION WORK.
5. THE CONTRACTOR SHALL VERIFY AND LOCATE ALL EXISTING ABOVE AND UNDERGROUND UTILITIES. LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND ARE SHOWN FOR GENERAL INFORMATION ONLY.
6. DAMAGE TO ANY EXISTING UTILITIES AND SERVICES TO REMAIN SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. CONTRACTOR SHALL REPAIR AND/OR REPLACE IN KIND. VERIFY EXISTING UTILITIES PRIOR TO CUT AND CAP PER PLAN. NOTIFY CIVIL ENGINEER IF ANY DISCREPANCIES ARE DISCOVERED IN FIELD.
7. EROSION CONTROL MEASURES SHALL BE IMPLEMENTED TO PREVENT DEBRIS AND UNSUITABLE MATERIALS FROM ENTERING STORM DRAINS, SANITARY SEWERS AND STREETS.
8. DUST CONTROL SHALL BE IMPLEMENTED DURING DEMOLITION.
9. DEMOLITION IS LIMITED TO WITHIN DEMOLITION LIMIT LINE UNLESS NOTED OTHERWISE.
10. THE CONTRACTOR SHALL VERIFY THE LOCATION AND QUANTITY OF EXISTING SURFACE STRUCTURES AND SHALL BE SOLELY RESPONSIBLE FOR ANY UNIDENTIFIED UTILITIES, IMPROVEMENTS, TREES, ETC. TO BE DEMOLISHED AND REMOVED WITHIN THE DEMOLITION LIMIT LINE, INCLUDING APPURTENANT FOUNDATIONS OR SUPPORTS.
11. DEMOLITION CALLOUTS IN THIS SECTION ARE REPRESENTATIVE OF WHAT IS TO BE DONE, NOT AN ITEMIZED ACCOUNTING FOR EACH PIPE, CATCH BASIN, MANHOLE, VAULT, ETC. THAT IS TO BE DEMOLISHED, REMOVED AND DISPOSED OF.

DEMOLITION NOTES:

PROTECT–IN–PLACE

1. PROTECT IN PLACE EXISTING BUILDING AND BUILDING FOOTINGS.
2. PROTECT IN PLACE EXISTING CONCRETE V–GUTTER.
3. PROTECT–IN–PLACE EXISTING WATER LINE.
4. PROTECT–IN–PLACE EXISTING SEWER LINE.
5. PROTECT–IN–PLACE EXISTING GAS LINE.
6. PROTECT–IN–PLACE EXISTING ELECTRICAL LINE.
7. PROTECT–IN–PLACE EXISTING CHILLED WATER LINE.
8. PROTECT–IN–PLACE EXISTING AC PAVEMENT.
9. PROTECT–IN–PLACE EXISTING ELECTRICAL VAULT.
10. PROTECT–IN–PLACE EXISTING CONCRETE PAVEMENT.
11. PROTECT–IN–PLACE EXISTING CONCRETE CURB.
12. PROTECT–IN–PLACE EXISTING CONCRETE CURB AND GUTTER.
13. PROTECT–IN–PLACE EXISTING STORM DRAIN LINE.
14. PROTECT–IN–PLACE EXISTING TELECOM LINE.
15. PROTECT–IN–PLACE EXISTING SITE LIGHT.
16. PROTECT–IN–PLACE EXISTING STORM DRAIN INLET.
17. PROTECT–IN–PLACE EXISTING TREE.
18. PROTECT–IN–PLACE EXISTING UTILITY YARD BOX.
19. PROTECT–IN–PLACE EXISTING OIL SWITCH. (3)
20. PROTECT–IN–PLACE EXISTING SEWER MANHOLE.
21. PROTECT–IN–PLACE EXISTING WATER VALVE.

REMOVE & DEMOLISH

1. REMOVE EXISTING BUILDING. REFER TO GEOTECH REPORT FOR DETAILS FOR REMOVAL OF EXISTING BUILDING FOOTINGS.
2. REMOVE AND DEMOLISH EXISTING CONCRETE PAVEMENT.
3. REMOVE AND DEMOLISH EXISTING AC PAVEMENT.
4. REMOVE AND DEMOLISH EXISTING TREE.
5. REMOVE AND DEMOLISH EXISTING 8FT SITE WALL.
6. REMOVE AND DEMOLISH EXISTING GATE.
7. REMOVE AND DEMOLISH EXISTING CURB.
8. REMOVE AND DEMOLISH EXISTING SITE LIGHT.COORDINATE WITH ELECTRICAL DEMO PLAN.
9. REMOVE AND DEMOLISH EXISTING SIGN.
10. REMOVE AND DEMOLISH EXISTING CURB AND GUTTER.
11. REMOVE AND DEMOLISH EXISTING CURB RAMP.
12. REMOVE AND DEMOLISH EXISTING GAS LINE.
13. REMOVE AND DEMOLISH EXISTING ELECTRICAL LINE. COORDINATE WITH ELECTRICAL DEMO PLAN.
14. REMOVE AND DEMOLISH EXISTING ELECTRICAL STRUCTURE.COORDINATE WITH ELECTRICAL DEMO PLAN.
15. REMOVE AND DEMOLISH EXISTING TELECOM LINE.
16. REMOVE AND DEMOLISH EXISTING WATER LINE.
17. REMOVE AND DEMOLISH EXISTING WATER TAP.
18. REMOVE AND DEMOLISH EXISTING WATER VALVE.
19. REMOVE AND DEMOLISH EXISTING ELECTRICAL VAULT.COORDINATE WITH ELECTRICAL DEMO PLAN.
20. REMOVE AND DEMOLISH EXISTING STORM DRAIN LINE.
21. REMOVE AND DEMOLISH EXISTING AREA DRAIN.
22. REMOVE AND DEMOLISH EXISTING SEWER LINE.
23. REMOVE AND DEMOLISH EXISTING SEWER CLEAN OUT.
24. REMOVE AND DEMOLISH EXISTING GAS VALVE.
25. REMOVE AND DEMOLISH EXISTING GATE. (3)
26. REMOVE AND DEMOLISH EXISTING CHAIN LINK FENCE.
27. REMOVE AND DEMOLISH EXISTING TRASH CAN.
28. REMOVE AND DEMOLISH EXISTING FIRE HYDRANT.
29. REMOVE AND DEMOLISH EXISTING TRUNCATED DOMES. (3)

LEGEND:

- LIMIT LINE OF WORK
- CUT AND CAP
- UTILITIES TO BE DEMOLISHED

EXISTING UTILITIES NOTE:

EXISTING UNDERGROUND UTILITIES ARE SHOWN BASED ON AVAILABLE RECORD AND AS–BUILT DRAWINGS. THE CONTRACTOR IS REQUIRED TO TAKE ALL PRECAUTIONARY MEASURES TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION AND PROTECT THE UTILITIES SHOWN AND ANY OTHER UTILITIES NOT SHOWN ON THIS PLAN.

NOTE TO CONTRACTOR:

CONTRACTOR SHALL COORDINATE WITH THE OWNER PRIOR TO DEMOTION AND REMOVAL OF EXISTING UTILITIES AND ITS APPURTENANT STRUCTURES TO ENSURE THAT UTILITY SERVICES TO THE ADJACENT/SURROUNDING EXISTING BUILDINGS ARE NOT INTERRUPTED.

SCALE: 1"=20'

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RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

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NAME: Reza Rebaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

DEMOLITION PLAN

DATE: JULY 06, 2017

C1.10

ADDENDA PACKAGE

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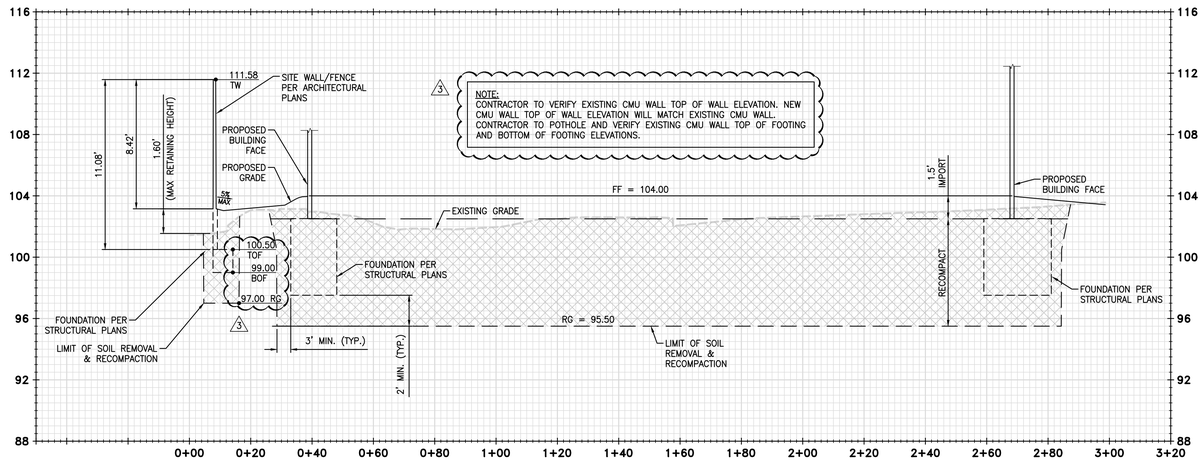

SECTION A
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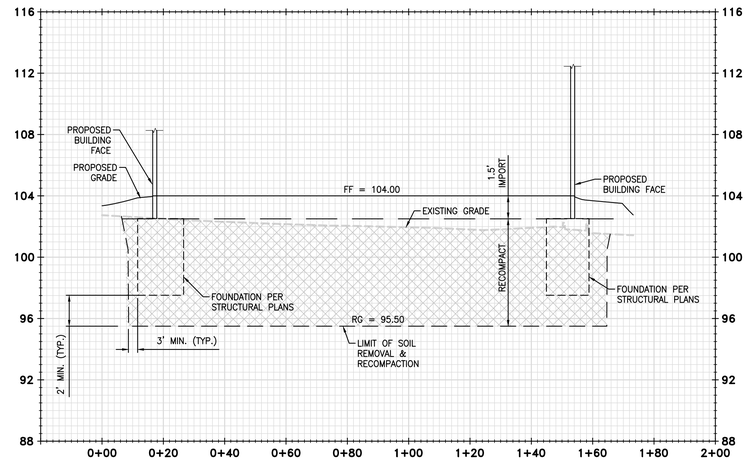
VERTICAL SCALE: 1"=4'

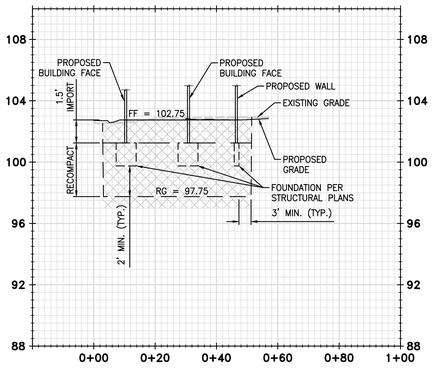


SECTION B
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=4'

NOTE:
PER GEOTECHNICAL ENGINEERING REPORT, DUE TO THE EXPANSION POTENTIAL OF ON-SITE NEAR SURFACE SOILS, ENGINEERED FILL WITHIN 18 INCHES FROM THE BOTTOM OF ALL FLOOR SLABS SHOULD CONSIST OF IMPORT LOW-VOLUME CHANGE MATERIALS (EI<20). ALL GRADING FOR EACH STRUCTURE SHOULD INCORPORATE THE LIMITS OF THE PROPOSED STRUCTURE PLUS A LATERAL DISTANCE OF 3 FEET BEYOND THE EDGES.

LEGEND:

TOTAL EXCAVATION AREA



SECTION C
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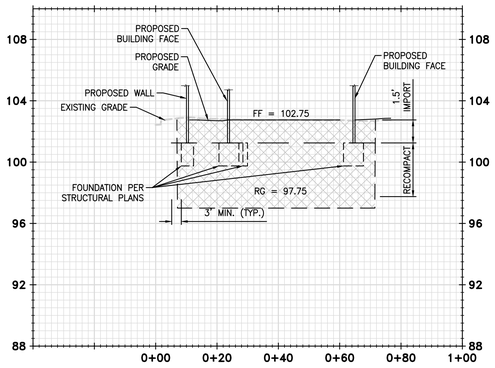
VERTICAL SCALE: 1"=4'



SECTION D
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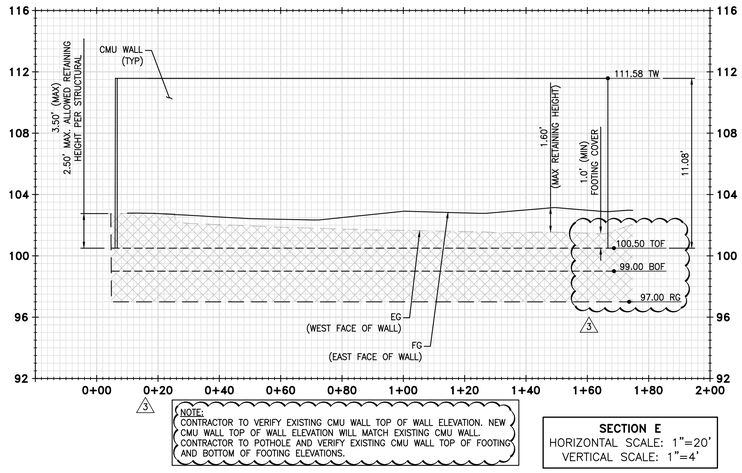
VERTICAL SCALE: 1"=4'



SECTION E
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=4'

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NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

ROUGH GRADING SECTIONS

DATE: JULY 06, 2017

C1.31

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LEGEND

LIMIT LINE OF WORK

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3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

GRADING PLAN

DATE: JULY 06, 2017

C1.33

ADDENDA PACKAGE

N

0 5' 10'
SCALE: 1"=10'

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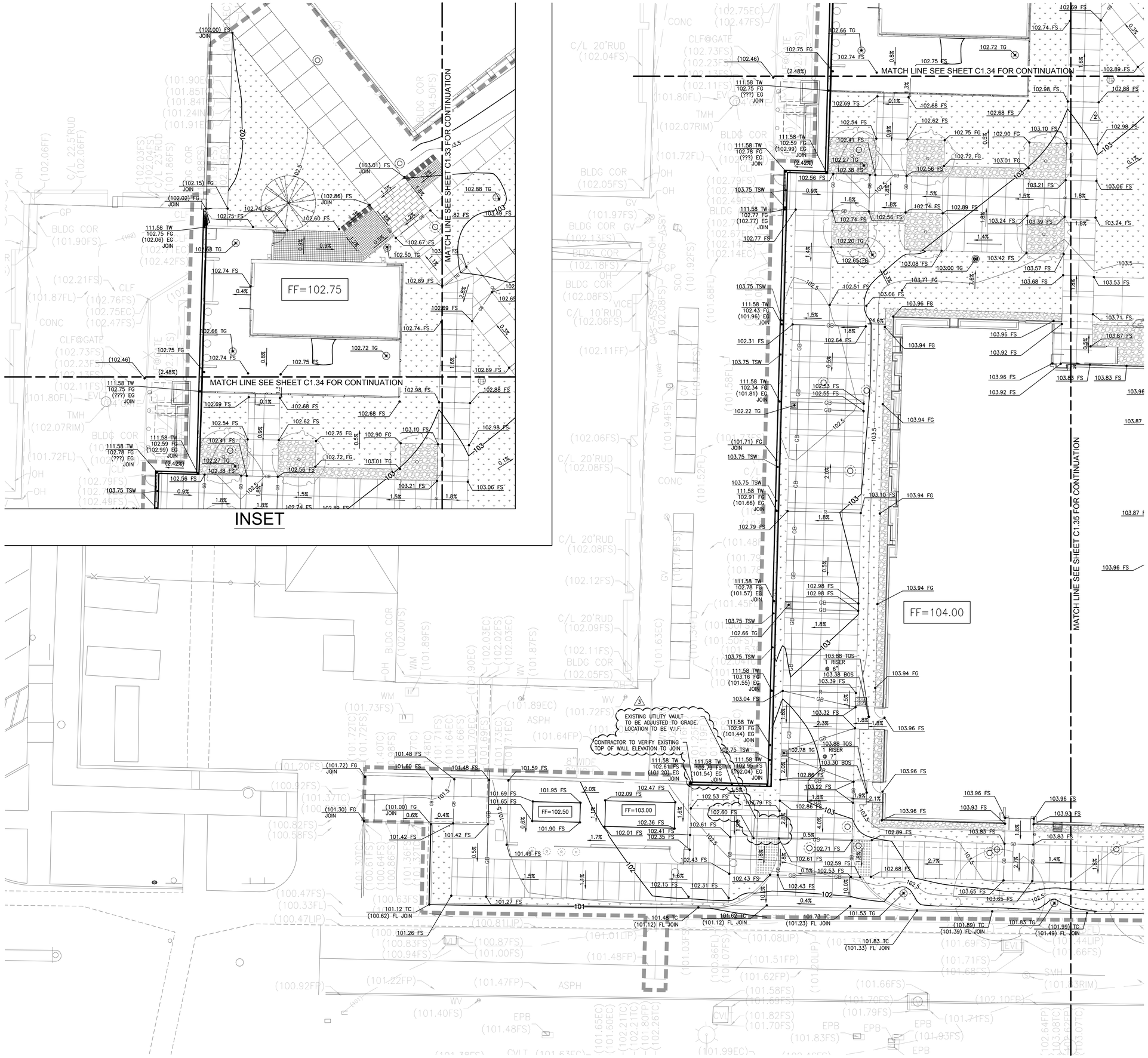

LEGEND

LIMIT LINE OF WORK

hga.

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3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

GRADING PLAN

DATE: JULY 06, 2017

C1.34

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N

0 5' 10'
SCALE: 1"=10'

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MATCH LINE SEE SHEET C1.34 INSET FOR CONTINUATION

MATCH LINE SEE SHEET C1.33 FOR CONTINUATION

MATCH LINE SEE SHEET C1.34 FOR CONTINUATION

FF=104.00

LEGEND

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NAME: Reza Rebaian
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ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

GRADING PLAN

DATE: JULY 06, 2017

C1.35

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SCALE: 1"=10'

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UTILITY CONSTRUCTION NOTES:

STORM DRAIN

- (SD1) PVC, SDR-35 STORM DRAIN PIPE PER DETAIL 2, SHEET C5.01. SIZE AND SLOPE PER PLAN.
- (SD2) POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.
- (SD3) CLEANOUT. PER DETAIL 8, SHEET C5.01.
- (SD4) 12"x12" PRECAST CONCRETE CATCH BASIN. HEAVY DUTY TRAFFIC RATED, HEEL PROOF, STAINLESS STEEL GRATE. JENSEN PRECAST PRODUCTS OR APPROVED EQUIVALENT.
- (SD5) CURB INLET PER APWA STANDARD PLAN 300-3 W=6' PER DETAIL 3, SHEET C5.02.
- (SD6) 6" DIAMETER ATRIUM DRAIN WITH UV PROTECTION. NDS PRODUCTS OR APPROVED EQUIVALENT.
- (SD7) TEMPORARY PRECAST OPEN BOTTOM CATCH BASIN FOR STORMWATER PRETREATMENT PER DETAIL 2, SHEET C5.03. TEMPORARY PRETREATMENT WILL BE REPLACED BY FUTURE CDS UNIT PER HEALTH SCIENCE BUILDING PROJECT.
- (SD8) FOOTING DRAIN PER DETAIL 3, SHEET C5.03.
- (SD9) CURB OVERFLOW STRUCTURE PER DETAIL 9, SHEET C5.02.
- (SD10) 3" PERFORATED PIPE PER DETAIL 10, SHEET C5.02. SLOPE PER PLAN.
- (SD11) 9" SQUARE PLASTIC GRATE WITH UV PROTECTION. NDS PRODUCTS OR APPROVED EQUIVALENT.
- (SD12) 4" AREA DRAIN PER PLUMBING PLANS, SHOWN FOR REFERENCE ONLY.
- (SD13) 60" DIAMETER X 270' LENGTH PERFORATED POLYMER COATED CMP BY CONTECH OR APPROVED EQUIVALENT.

LEGEND

LIMIT LINE OF WORK

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NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

STORM DRAINAGE PLAN

DATE: JULY 06, 2017

C1.40

ADDENDA PACKAGE

N

0 10' 20'
SCALE: 1"=20'

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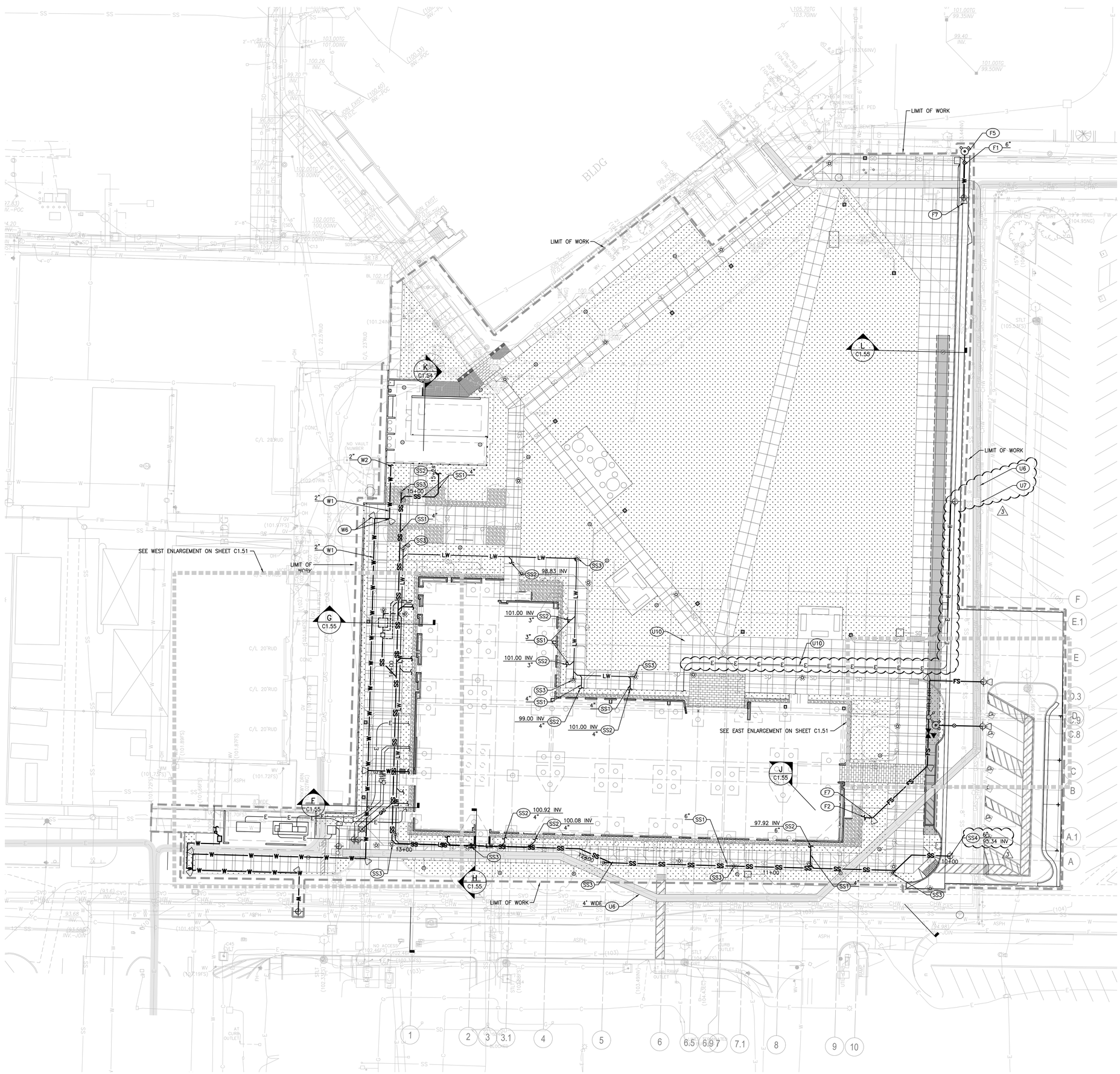

UTILITY CONSTRUCTION NOTES:

SANITARY SEWER

(SS1) PVC, SDR-35 SANITARY SEWER PIPE PER DETAIL 2, SHEET C5.01. SIZE AND SLOPE PER PLAN.

(SS2) POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.

(SS3) CLEANOUT. PER DETAIL 8, SHEET C5.01.

(SS4) POINT OF CONNECTION TO EXISTING SANITARY SEWER LATERAL PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

DOMESTIC WATER

(W1) PVC C-900 DOMESTIC WATER PIPE PER DETAIL 2, SHEET C5.01. SIZE PER PLAN.

(W2) POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.

(W3) BACKFLOW PREVENTION DEVICE. PER DETAIL 1, SHEET C5.01.

(W4) IRRIGATION WATER METER VAULT. INSTALLATION BY CONTRACTOR. SHOWN FOR COORDINATION PURPOSES ONLY. CONTRACTOR TO COORDINATE WATER METER OR SUBMETER SERVICE CONNECTION WITH SANTA ANA COLLEGE.

(W5) POINT OF CONNECTION TO EXISTING DOMESTIC WATER LATERAL PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(W6) THRUST BLOCK. PER DETAIL 3, SHEET C5.01.

(W7) LINE SIZE SHUT-OFF-VALVE IN YARD BOX WITH COVER MARKED "WATER". SEE PLUMBING DRAWINGS FOR MORE DETAILS. SHOWN FOR REFERENCE ONLY.

(W8) IRRIGATION PUMP. SEE IRRIGATION PLANS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(W9) IRRIGATION CONTROLLER. SEE IRRIGATION PLANS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(W10) IRRIGATION BACKFLOW PREVENTION DEVICE. SEE IRRIGATION PLANS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

FIRE WATER

(F1) PVC C-900 FIRE WATER PIPE PER DETAIL 2, SHEET C5.01. SIZE AND MATERIAL PER PLAN.

(F2) POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.

(F3) DOUBLE DETECTOR CHECK VALVE ASSEMBLY WITH FIRE DEPARTMENT CONNECTION. PER DETAIL 1, SHEET C5.01. BACKFLOW PREVENTION DEVICE, AMES 3000CIV OR APPROVED EQUIVALENT. SIZE PER PLAN

(F4) HOT TAP CONNECTION OR CUT-IN-TEE CONNECTION TO EXISTING 12" CAMPUS FIRE MAIN. INSTALLATION BY CONTRACTOR. SHOWN FOR COORDINATION PURPOSES ONLY. CONTRACTOR TO COORDINATE FIRE WATER SERVICE CONNECTION WITH SANTA ANA COLLEGE.

(F5) NEW CLOW FIRE HYDRANT F-2545 OR DISTRICT APPROVED EQUIVALENT PER DETAIL 5, SHEET C5.01. 3

(F6) EXISTING FIRE SERVICE LATERAL PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(F7) THRUST BLOCK. PER DETAIL 3, SHEET C5.01.

(F8) POST INDICATOR VALVE PER DETAIL 4, SHEET C5.02.

OTHER UTILITIES

(U1) ELECTRICAL CONDUIT. SEE ELECTRICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U2) GAS LINE. SEE PLUMBING DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U3) MECHANICAL LINE. SEE MECHANICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U4) POINT OF CONNECTION TO EXISTING GAS LINE PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(U5) CHILLED WATER SUPPLY AND RETURN PIPE. SEE MECHANICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U6) EXISTING ELECTRICAL CONDUIT PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(U7) EXISTING ELECTRICAL VAULT PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(U8) POINT OF CONNECTION TO EXISTING CHILLED WATER LINES. SEE MECHANICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U9) POINT OF CONNECTION TO EXISTING ELECTRICAL VAULT. SEE ELECTRICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U10) COMMUNICATIONS CONDUITS. SEE ELECTRICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY. 3

LEGEND

- LIMIT OF WORK
- FIRE HYDRANT
- VALVES
- THRUST BLOCK
- POINT OF CONNECTION
- CLEAN OUT
- METER VAULT
- BACKFLOW PROTECTION DEVICE
- FIRE DEPARTMENT CONNECTION

EXISTING UTILITIES NOTE:

EXISTING UNDERGROUND UTILITIES ARE SHOWN BASED ON AVAILABLE RECORD AND AS-BUILT DRAWINGS. THE CONTRACTOR IS REQUIRED TO TAKE ALL PRECAUTIONARY MEASURES TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION AND PROTECT THE UTILITIES SHOWN AND ANY OTHER UTILITIES NOT SHOWN ON THIS PLAN.

N

0 10' 20'

SCALE: 1"=20'

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NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: BV

HGA NO: 3584-001-00

UTILITY PLAN

DATE: JULY 06, 2017

C1.50

ADDENDA PACKAGE

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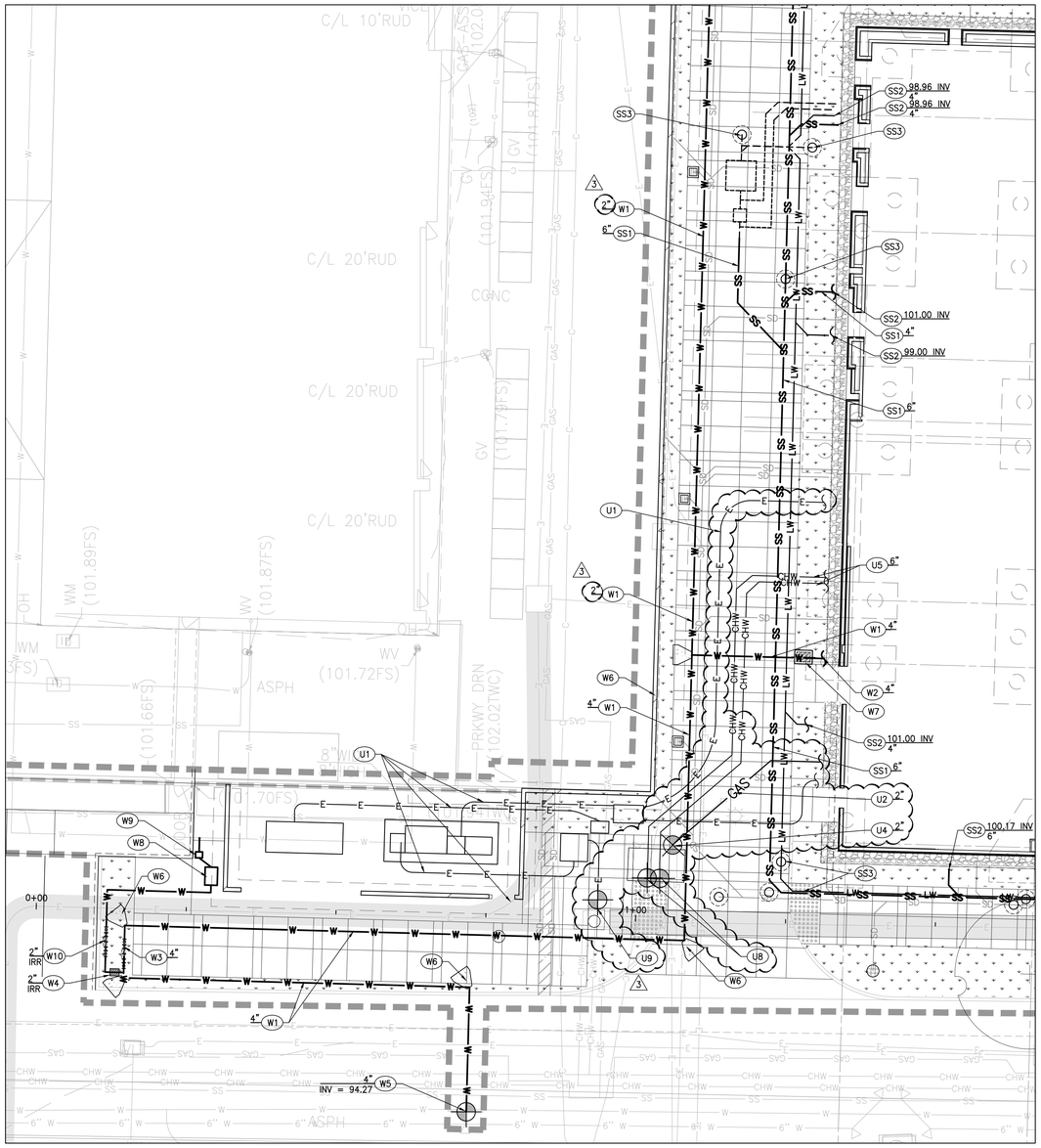

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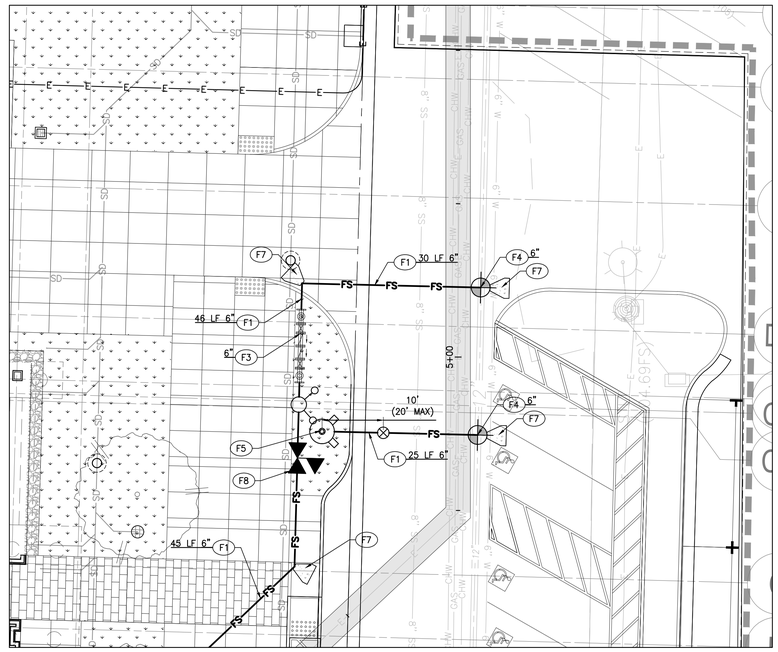

EAST ENLARGEMENT

SCALE: 1"=10'

UTILITY CONSTRUCTION NOTES:

SANITARY SEWER

(SS1) PVC, SDR-35 SANITARY SEWER PIPE PER DETAIL 2, SHEET C5.01. SIZE AND SLOPE PER PLAN.

(SS2) POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.

(SS3) CLEANOUT. PER DETAIL 8, SHEET C5.01.

(SS4) POINT OF CONNECTION TO EXISTING SANITARY SEWER LATERAL PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

DOMESTIC WATER

(W1) PVC C-900 DOMESTIC WATER PIPE PER DETAIL 2, SHEET C5.01. SIZE PER PLAN.

(W2) POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.

(W3) BACKFLOW PREVENTION DEVICE. PER DETAIL 1, SHEET C5.01.

(W4) IRRIGATION WATER METER VAULT. INSTALLATION BY CONTRACTOR. SHOWN FOR COORDINATION PURPOSES ONLY. CONTRACTOR TO COORDINATE WATER METER OR SUBMETER SERVICE CONNECTION WITH SANTA ANA COLLEGE.

(W5) POINT OF CONNECTION TO EXISTING DOMESTIC WATER LATERAL PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(W6) THRUST BLOCK. PER DETAIL 3, SHEET C5.01.

(W7) LINE SIZE SHUT-OFF-VALVE IN YARD BOX WITH COVER MARKED "WATER". SEE PLUMBING DRAWINGS FOR MORE DETAILS. SHOWN FOR REFERENCE ONLY.

(W8) IRRIGATION PUMP. SEE IRRIGATION PLANS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(W9) IRRIGATION CONTROLLER. SEE IRRIGATION PLANS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(W10) IRRIGATION BACKFLOW PREVENTION DEVICE. SEE IRRIGATION PLANS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

FIRE WATER

(F1) PVC C-900 FIRE WATER PIPE PER DETAIL 2, SHEET C5.01. SIZE AND MATERIAL PER PLAN.

(F2) POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.

(F3) DOUBLE DETECTOR CHECK VALVE ASSEMBLY WITH FIRE DEPARTMENT CONNECTION. PER DETAIL 1, SHEET C5.01. BACKFLOW PREVENTION DEVICE, AMES 3000CIV OR APPROVED EQUIVALENT. SIZE PER PLAN

(F4) HOT TAP CONNECTION OR CUT-IN-TEE CONNECTION TO EXISTING 12" CAMPUS FIRE MAIN. INSTALLATION BY CONTRACTOR. SHOWN FOR COORDINATION PURPOSES ONLY. CONTRACTOR TO COORDINATE FIRE WATER SERVICE CONNECTION WITH SANTA ANA COLLEGE.

(F5) NEW CLOW FIRE HYDRANT F-2545 OR DISTRICT APPROVED EQUIVALENT PER DETAIL 5, SHEET C5.01.

(F6) EXISTING FIRE SERVICE LATERAL PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(F7) THRUST BLOCK. PER DETAIL 3, SHEET C5.01.

(F8) POST INDICATOR VALVE PER DETAIL 4, SHEET C5.02.

OTHER UTILITIES

(U1) ELECTRICAL CONDUIT. SEE ELECTRICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U2) GAS LINE. SEE PLUMBING DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U3) MECHANICAL LINE. SEE MECHANICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U4) POINT OF CONNECTION TO EXISTING GAS LINE PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

(U5) CHILLED WATER SUPPLY AND RETURN PIPE. SEE MECHANICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

(U6) EXISTING ELECTRICAL CONDUIT PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.

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(U10) COMMUNICATIONS CONDUITS. SEE ELECTRICAL DRAWINGS FOR DETAILS AND SPECIFICATIONS. SHOWN FOR COORDINATION PURPOSES ONLY.

△3

LEGEND

- LIMIT OF WORK
- FIRE HYDRANT
- VALVES
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N

0 5' 10'

SCALE: 1"=10'

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REGISTERED ENGINEER SAIFUL S. M. BOUQUET No. 58882 CIVIL STATE OF CALIFORNIA

PROFESSIONAL ENGINEER REZA REZAIAN No. C62048 CIVIL STATE OF CALIFORNIA

NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

△NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

UTILITY PLAN ENLARGEMENT

DATE: JULY 06, 2017

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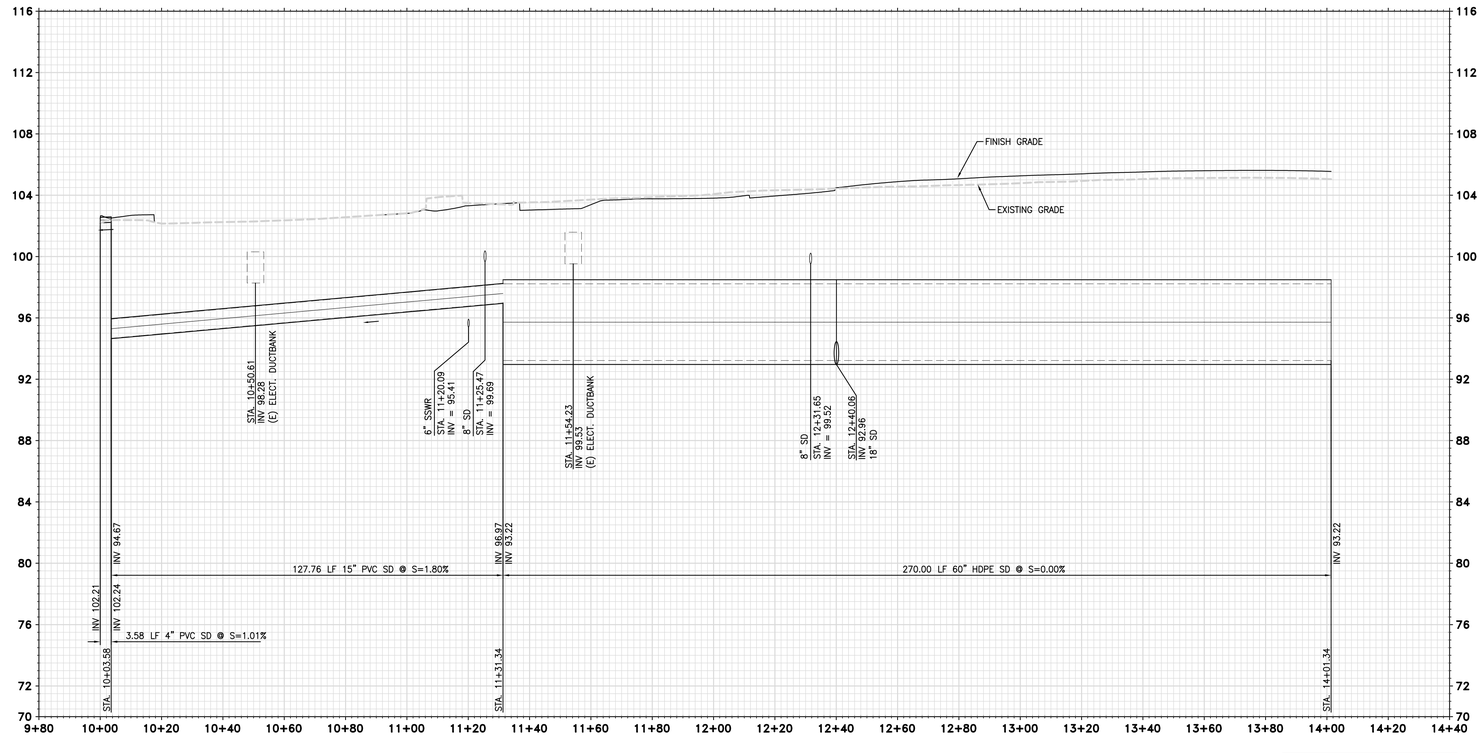

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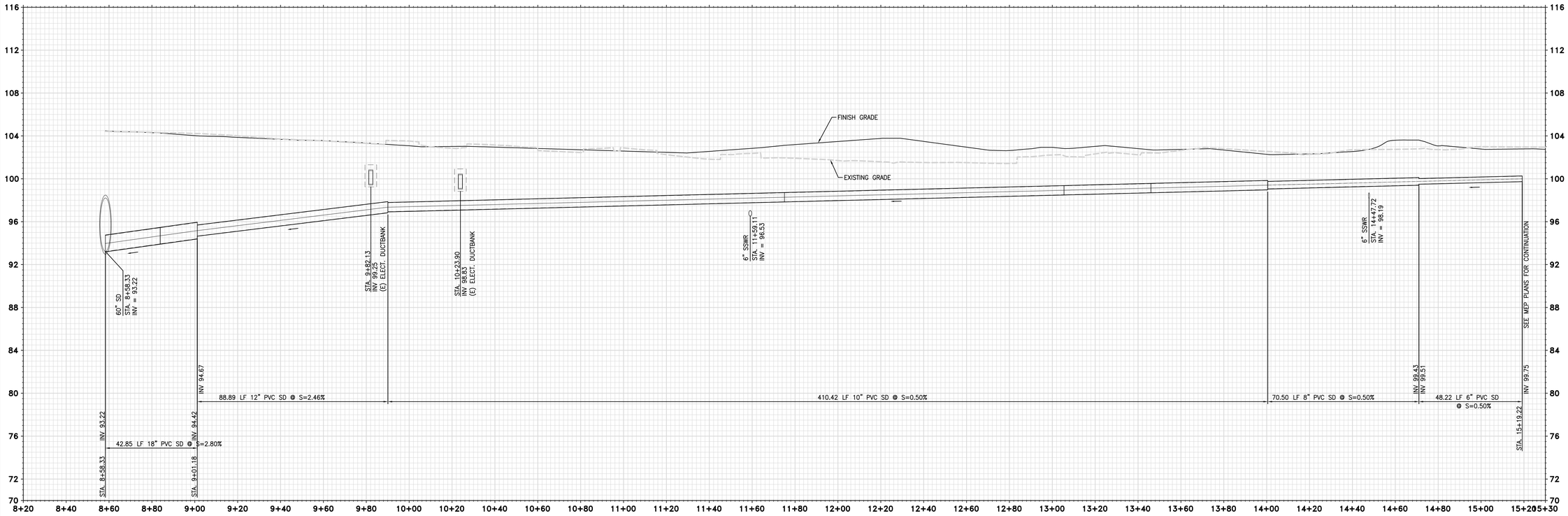

SD–20
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=4'

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NAME: Reza Rezaie
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: BV

HGA NO: 3584-001-00

STORM DRAIN PROFILES

DATE: JULY 06, 2017

△3 C1.52 ADDENDA PACKAGE

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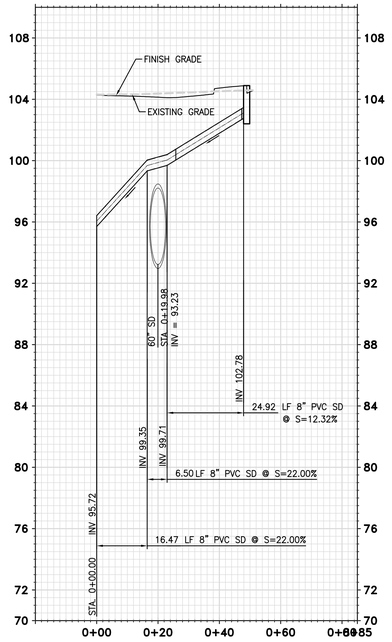

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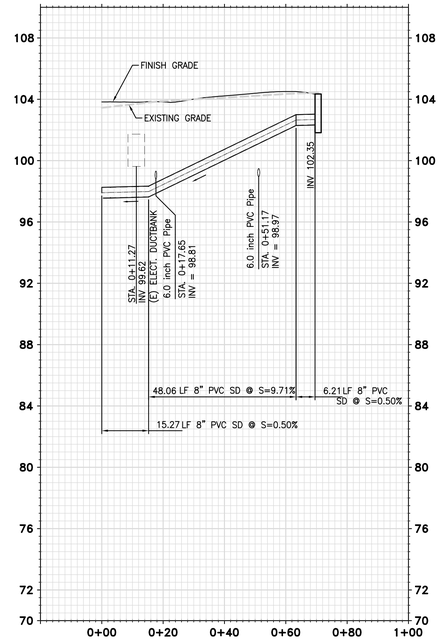

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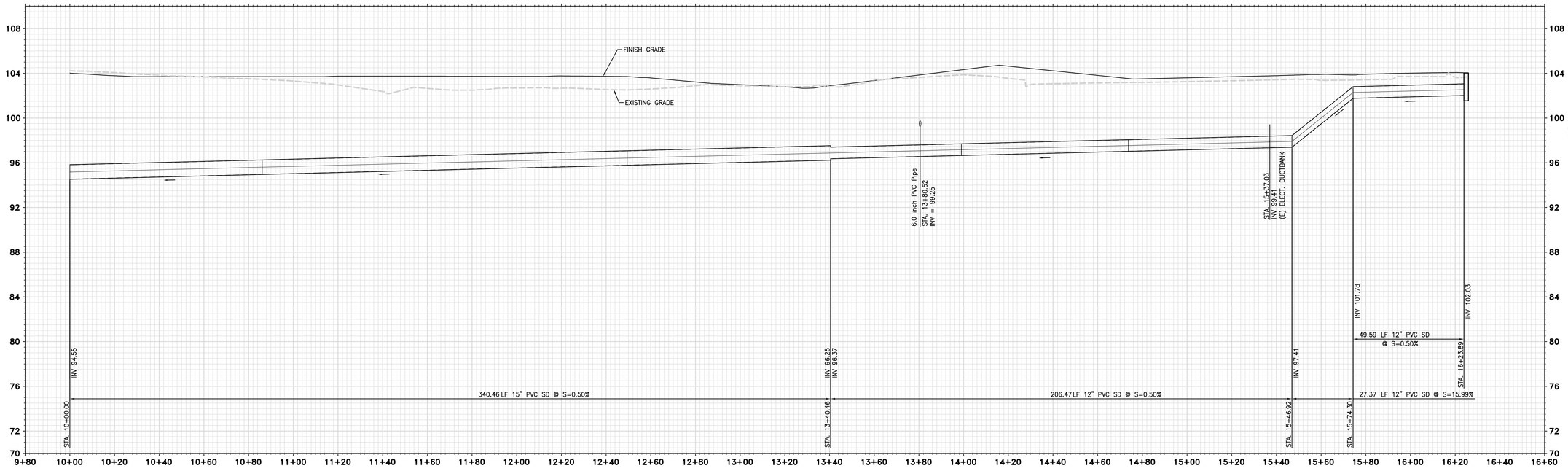

SD-30
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=4'

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REGISTERED PROFESSIONAL ENGINEER REZA REZAIAN C62048 CIVIL STATE OF CALIFORNIA

LICENSED ARCHITECT JAMES G. HAMMEL STATE OF CALIFORNIA SEPTEMBER 30, 2017 RENEWAL DATE

NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: BV

HGA NO: 3584-001-00

STORM DRAIN PROFILES

DATE: JULY 06, 2017

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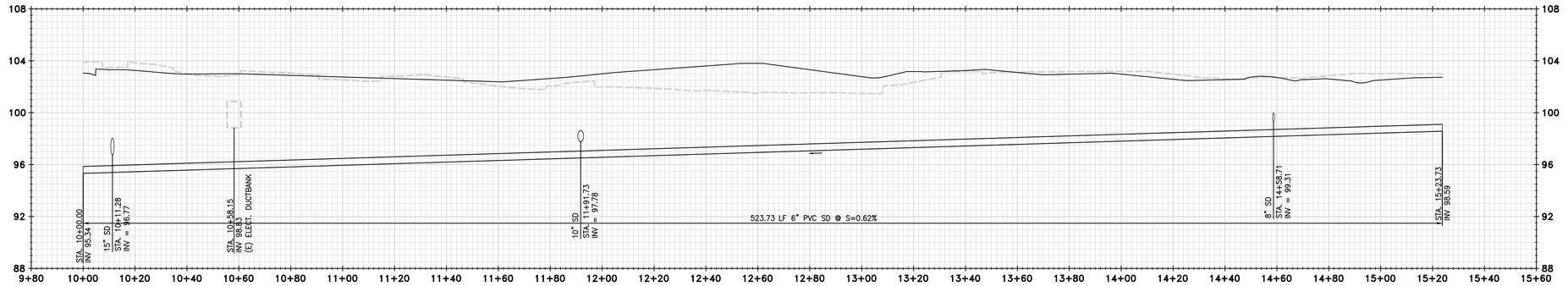

SSWR-10
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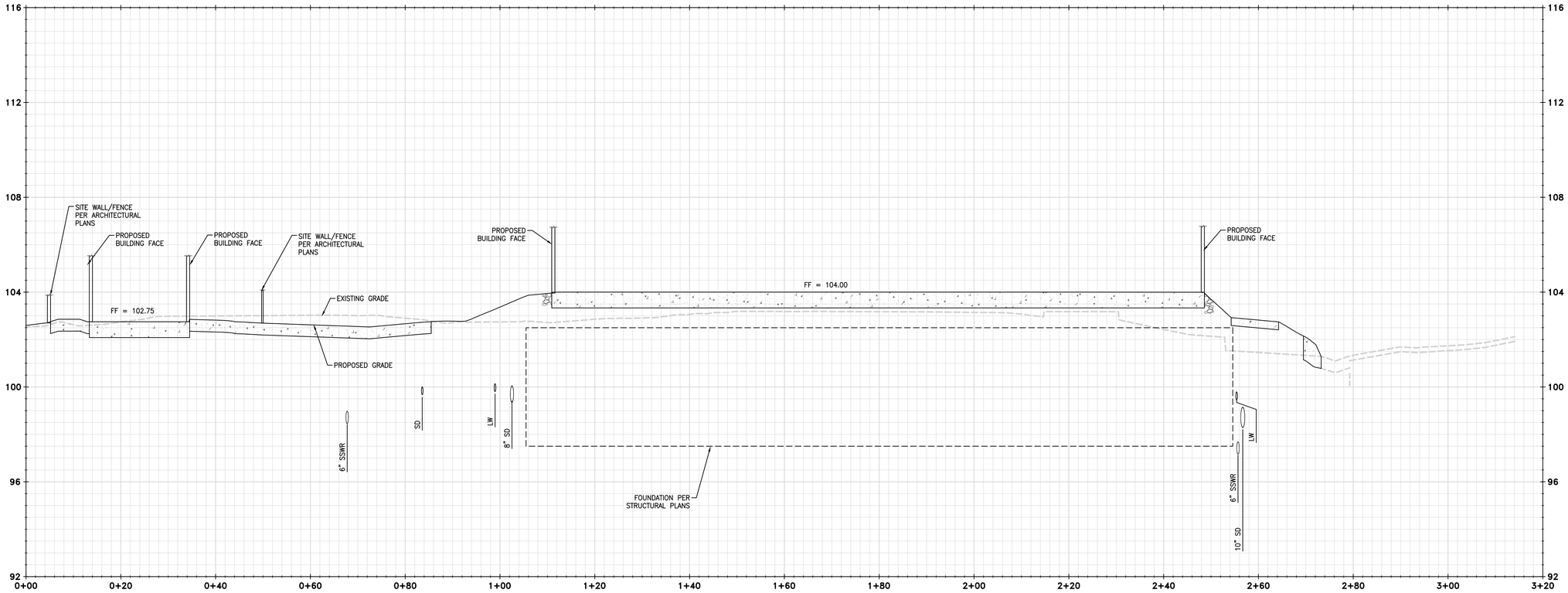

UTL – SECTION K
HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=2'

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NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

SEWER PROFILES

DATE: JULY 06, 2017

3 ADDENDA PACKAGE

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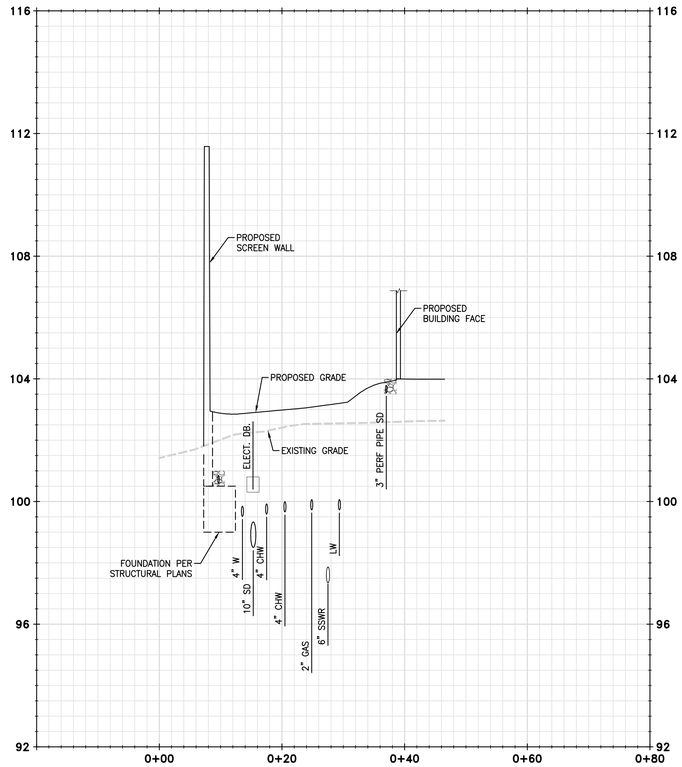

SECTION F
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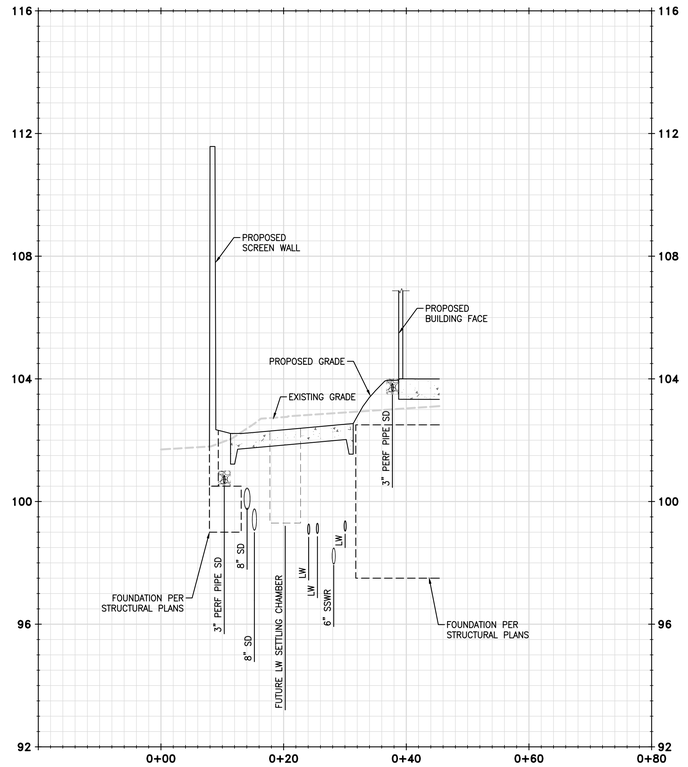

UTL – SECTION G
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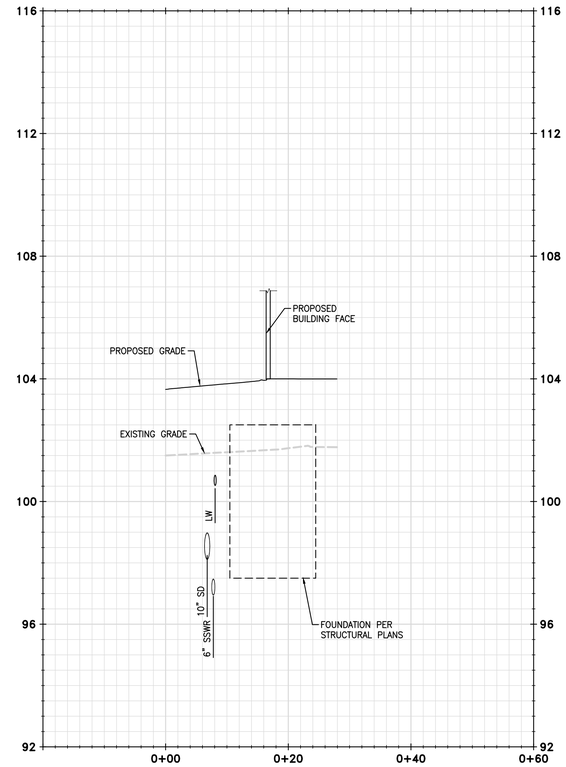

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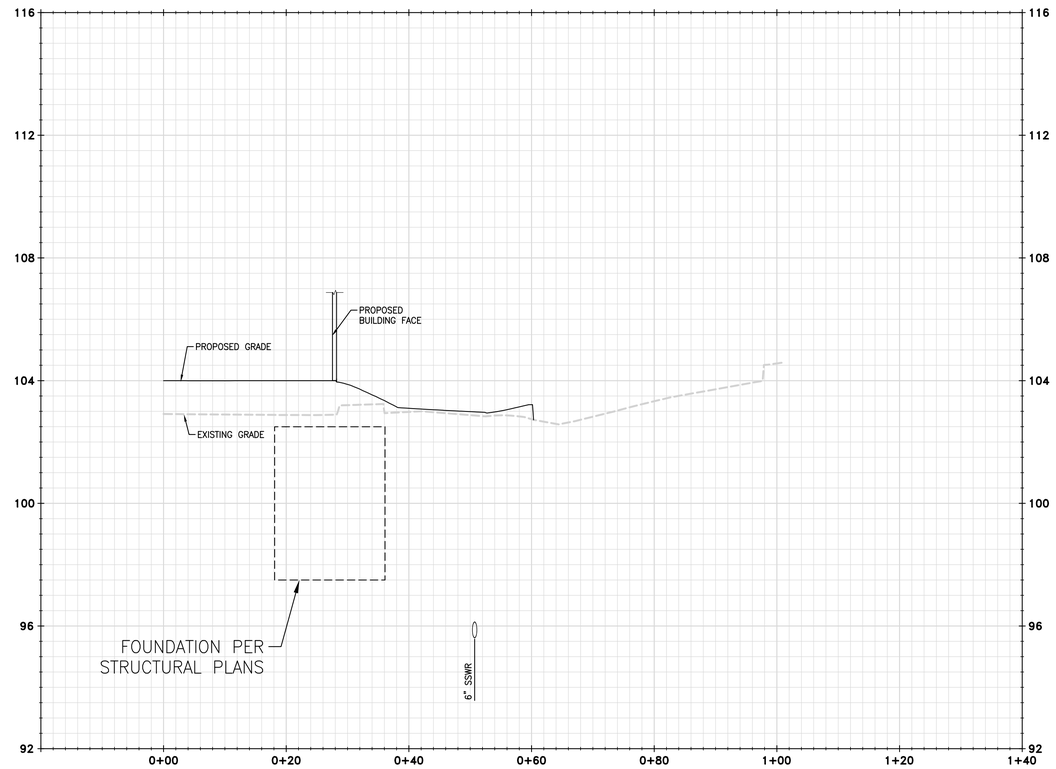

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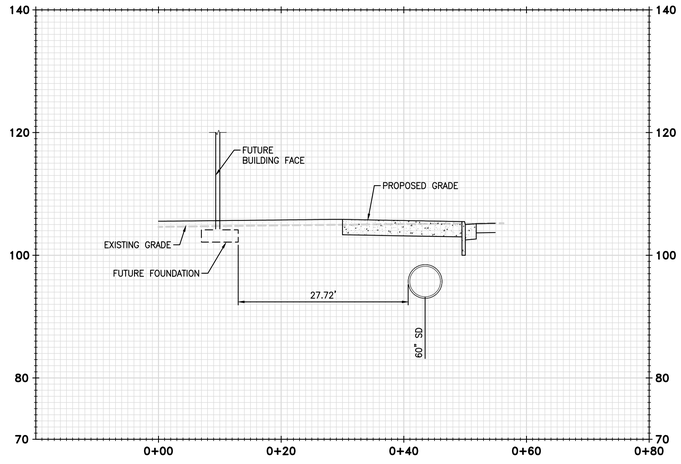

UTL – SECTION L
HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME, OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF CALIFORNIA.

LICENSED ARCHITECT — REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

UTILITY SECTIONS

DATE: JULY 06, 2017

△3 C1.55 ADDENDA PACKAGE

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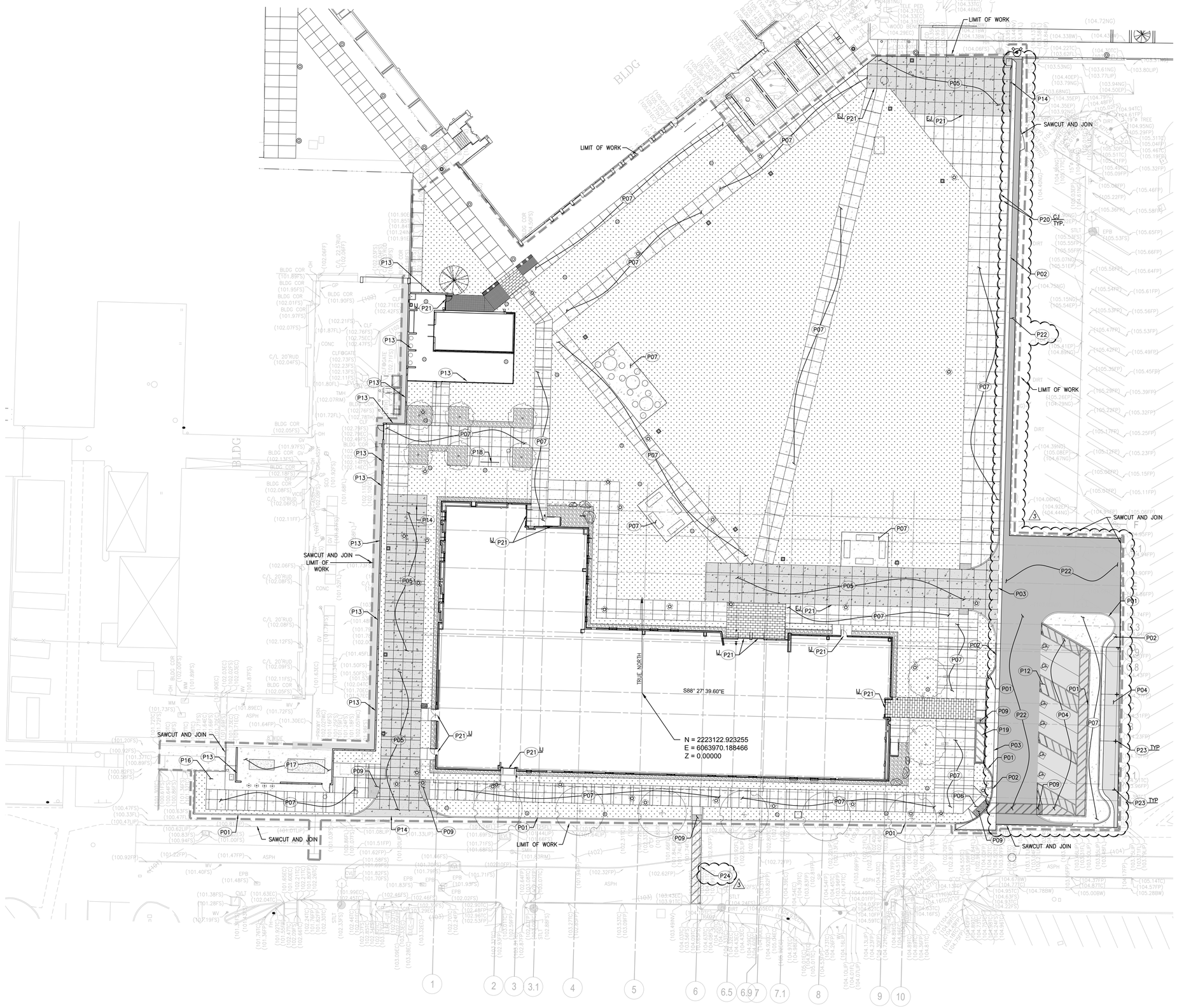
P:\2014\114225 Santa Ana College STEM Project\DWG\SHEET\114225-C1.55SC.dwg, Sep 22, 2017 - 11:58am



PAVING CONSTRUCTION NOTES

- P01 CONCRETE CURB. PER DETAIL 8, PER SHEET C5.00.
- P02 CONCRETE CURB AND GUTTER. PER DETAIL 6, PER SHEET C5.00.
- P03 CONCRETE VALLEY GUTTER. PER DETAIL 9, PER SHEET C5.00.
- P04 ASPHALT CONCRETE PAVEMENT. PER DETAIL 2, PER SHEET C5.00.
- P05 HEAVY DUTY VEHICULAR CONCRETE PAVEMENT. PER DETAIL 4, PER SHEET C5.00.
- P06 CURB RAMP. PER DETAIL 10, PER SHEET C5.00.
- P07 CONCRETE WALK PAVEMENT. PER DETAIL 7, PER SHEET C5.00.
- P08 CONCRETE BENCH. PER LANDSCAPE ARCHITECT PLANS.
- P09 TRUNCATED DOMES. PER DETAIL 11, PER SHEET C5.00.
- P10 FENCE. PER ARCHITECTURAL PLANS.
- P11 WHEEL STOP. PER DETAIL 2, PER SHEET C5.02.
- P12 ADA STRIPING PER DETAIL 8, SHEET C5.02.
- P13 CMU WALL. PER ARCHITECTURAL PLANS.
- P14 CONCRETE ROLLED CURB. PER DETAIL 5, SHEET C5.02.
- P15 PARKING STALL STRIPING. PER DETAIL 6, SHEET C5.02.
- P16 IRRIGATION PUMP CONCRETE PAD.
- P17 ELECTRICAL EQUIPMENT CONCRETE PAD PER STRUCTURAL PLANS.
- P18 BIKE RACK PER LANDSCAPE ARCHITECT PLANS.
- P19 LOADING AREA STRIPING PER ARCHITECTURAL PLANS. (3)
- P20 CONTROL JOINTS PER DETAIL 3, SHEET C5.00. LOCATION PER CONSTRUCTION PLAN SHEET L1.01.
- P21 EXPANSION JOINTS/ISOLATION JOINTS PER DETAIL 1, SHEET C5.00. LOCATION PER CONSTRUCTION PLAN SHEET L1.01.
- P22 HEAVY DUTY VEHICULAR ASPHALT PAVEMENT PER DETAIL 2, SHEET C5.00. (3)
- P23 PARALLEL PARKING STALLS STRIPING PER DETAIL 7, SHEET C5.02.
- P24 CROSSWALK STRIPING PER DETAIL 1, SHEET C5.03.

ABBREVIATIONS

IJ = ISOLATION JOINT

EJ = EXPANSION JOINT

CJ = CONTROL JOINT

LEGEND

- CONCRETE PAVING (REFER TO SHEET C5.00 FOR DETAILS)
- VEHICULAR CONCRETE PAVING (REFER TO SHEET C5.00 FOR DETAILS)
- ASPHALT (REFER TO SHEET C5.00 FOR DETAILS)
- HEAVY DUTY ASPHALT (REFER TO SHEET C5.00 FOR DETAILS) (3)
- LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
- LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
- BRICK PAVERS (REFER TO LANDSCAPING PLANS FOR DETAILS)
- SITE WALL (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
- CONCRETE SEAT WALL (REFER TO LANDSCAPING PLANS FOR DETAILS)
- FENCE (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
- LIMIT OF WORK

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REGISTERED ARCHITECT — JAMES G. HAMMEL — EXPIRATION 31-2017 RENEWAL DATE — STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER — ORAZIO S. PUGLIA — No. C62048 — CIVIL — STATE OF CALIFORNIA

NAME: Yeza Radaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: BV

HGA NO: 3584-001-00

PAVING PLAN

DATE: JULY 06, 2017

C1.60

ADDENDA PACKAGE

N

0 10' 20'
SCALE: 1"=20'

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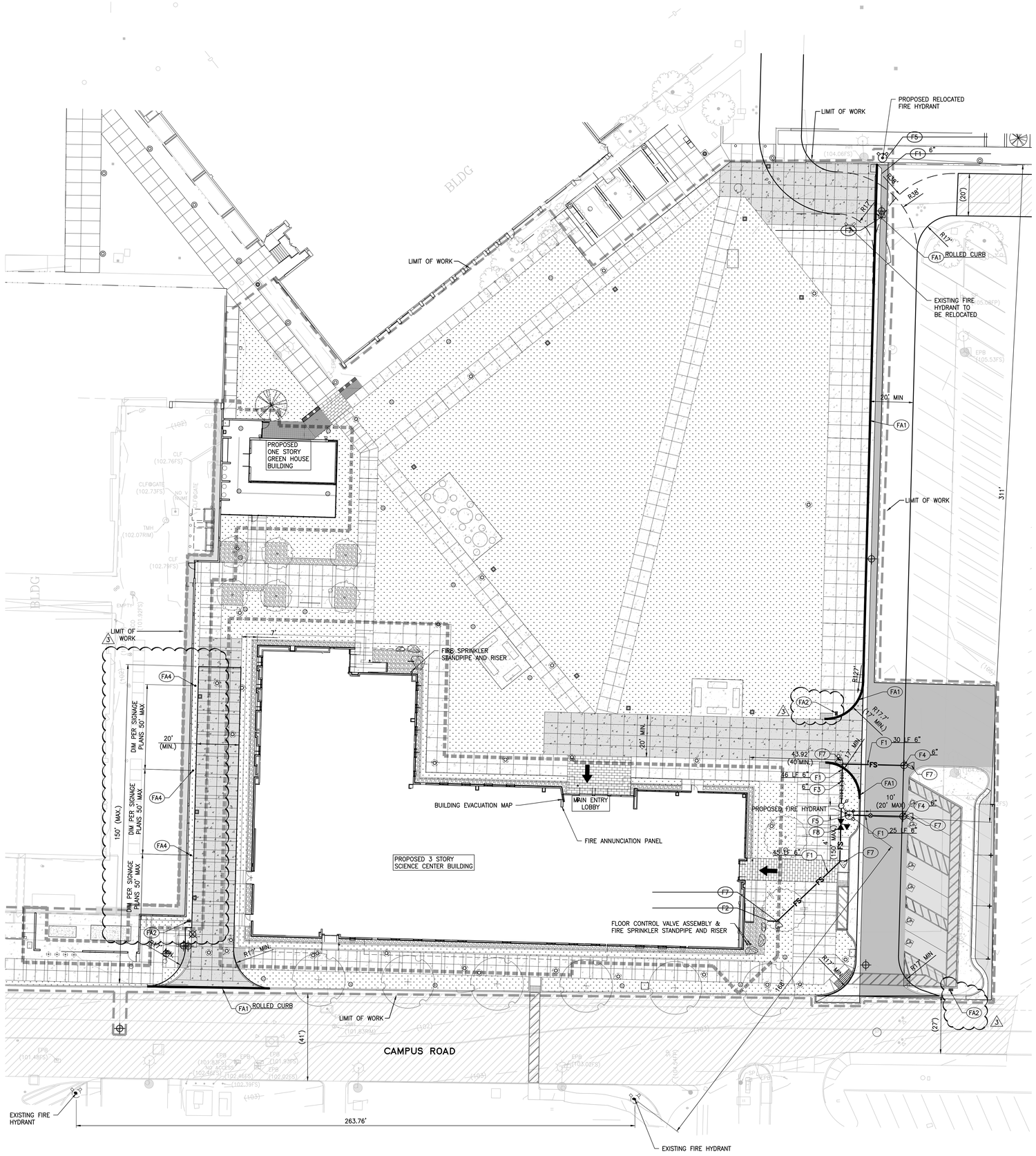


CONSTRUCTION NOTES:

- FA1 FIRE LANE IDENTIFICATION – RED CURBS PER ORANGE COUNTY FIRE AUTHORITY GUIDELINE B-10, ATTACHMENT 4. SEE DETAIL 1, HEREON.
- FA2 "FIRE LANE–NO PARKING" ENTRANCE SIGN PER ORANGE COUNTY FIRE AUTHORITY GUIDELINE B-10, ATTACHMENT 5. SEE DETAIL 2, HEREON. REFER TO SIGNAGE PLANS. 3
- FA3 WALL MOUNTED "FIRE LANE–NO PARKING" SIGN PER ORANGE COUNTY FIRE AUTHORITY GUIDELINE B-10, ATTACHMENT 7. SEE DETAIL 3, HEREON. REFER TO SIGNAGE PLANS. 3
- FA4 POST MOUNTED "FIRE LANE–NO PARKING" SIGN PER ORANGE COUNTY FIRE AUTHORITY GUIDELINE B-10, ATTACHMENT 7. SEE DETAIL 3, HEREON. REFER TO SIGNAGE PLANS. 3

LEGEND

- EXISTING CAMPUS FIRE LANE
- PROPOSED CAMPUS FIRE LANE
- PROPOSED FIRE LANE STRIPING (RED CURB PAINT)
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- PIV
- FIRE DEPARTMENT CONNECTION
- BACKFLOW PREVENTOR
- THRUST BLOCK
- POINT OF CONNECTION
- LIMIT OF WORK

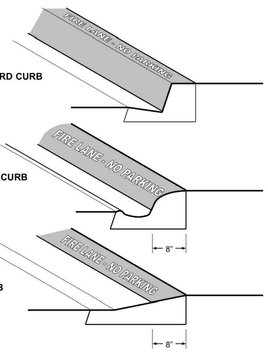
FIRE WATER

- F1 PVC C-900 FIRE WATER PIPE PER DETAIL 2, SHEET C5.01. SIZE AND MATERIAL PER PLAN.
- F2 POINT OF CONNECTION 5 FEET FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION.
- F3 DOUBLE DETECTOR CHECK VALVE ASSEMBLY WITH FIRE DEPARTMENT CONNECTION. PER DETAIL 1, SHEET C5.01.
- F4 HOT TAP CONNECTION OR CUT-IN-TEE CONNECTION TO EXISTING 12" CAMPUS FIRE MAIN. INSTALLATION BY CONTRACTOR. SHOWN FOR COORDINATION PURPOSES ONLY. CONTRACTOR TO COORDINATE FIRE WATER SERVICE CONNECTION WITH SANTA ANA COLLEGE.
- F5 FIRE HYDRANT. PER DETAIL 5, SHEET C5.01.
- F6 EXISTING FIRE SERVICE LATERAL PER SAC INFRASTRUCTURE RENOVATION PROJECT. VERIFY IN FIELD. SHOWN FOR REFERENCE ONLY.
- F7 THRUST BLOCK. PER DETAIL 3, SHEET C5.01.
- F8 POST INDICATOR VALVE PER DETAIL 1, SHEET C5.03.

NOTES:
1. THE ESTIMATED QUANTITIES PROVIDED ABOVE ARE TO BE USED FOR JURISDICTIONAL PLAN CHECKING AND PERMITTING PURPOSES ONLY.
2. THE CONTRACTOR SHALL CALCULATE HIS OWN QUANTITIES NECESSARY FOR HIS BID AND WORK.

ATTACHMENT 4

Fire Lane Identification – Red Curbs



1. Fire lane entrance sign(s) shall be provided per Attachment 5.
2. Curbs shall be painted OSHA safety red.
3. "FIRE LANE – NO PARKING" shall be painted on top of curb in 3" white lettering at a spacing of 30' on center or portion thereof.

1 HEREON FIRE LANE IDENTIFICATION N.T.S.

ATTACHMENT 5

Specifications for Fire Lane Entrance Signs
To be used only at *vehicle entry points* to areas that contain "Fire Lane—No Parking" signs or red curb

All sign and lettering dimensions shown are minimums. "Arial Narrow" font used in sample above, though other legible sans-serif fonts may be acceptable.

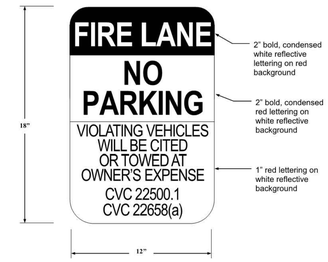
This sign shall be posted at all vehicle entrances to areas marked with either red curbs or fire lane "No Parking" signs. Signs shall be securely mounted facing the direction of travel and clearly visible to oncoming traffic entering the designated area. Signs shall be made of durable material and installed per Attachments 13 and 14.

Towing company contact information is required for all properties with a standing written agreement for services with a towing company per the California Vehicle Code.

2 HEREON FIRE LANE ENTRANCE SIGN N.T.S.

ATTACHMENT 7

Specifications for Fire Lane No Parking Signs



All sign and lettering dimensions shown are *minimums*. "Arial Narrow" font used in sample above, though other legible sans-serif fonts may be acceptable.

Signs shall be securely mounted facing the direction of travel and clearly visible to oncoming traffic entering the designated area. Signs shall be made of durable material and installed per Attachments 13 and 14.

3 HEREON FIRE LANE "NO PARKING" SIGN N.T.S.

N

0 10' 20'
SCALE: 1"=20'

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REGISTERED ARCHITECT JAMES G. MAHAFFEY NO. 18855 STATE OF CALIFORNIA SEPTEMBER 30, 2017 RENEWAL DATE

REGISTERED PROFESSIONAL ENGINEER PAUL A. ZIMA C62048 CIVIL STATE OF CALIFORNIA

NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: BV

HGA NO: 3584-001-00

FIRE HYDRANT AND ACCESS PLAN

DATE: JULY 06, 2017

C1.70

ADDENDA PACKAGE

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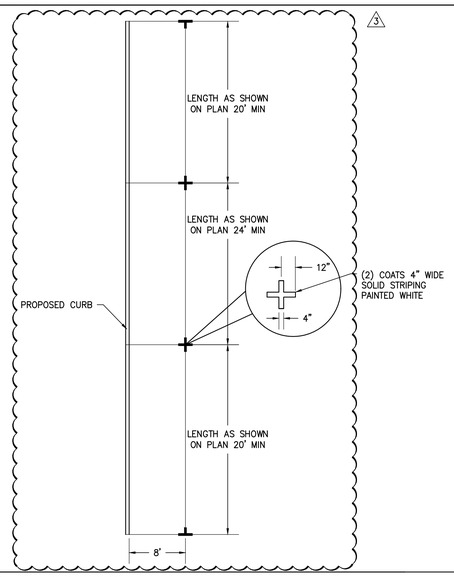
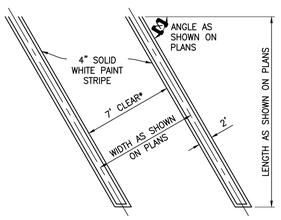
8 ANGLED ACCESSIBLE PARKING STALL

N.T.S.



7 PARALLEL PARKING STALL

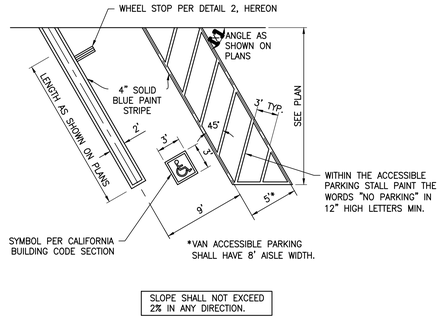
N.T.S.



* COMPACT SPACES SHALL HAVE 6' CLEAR DISTANCE.

6 ANGLED PARKING STALL

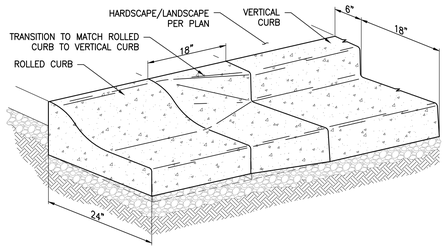
N.T.S.



SLOPE SHALL NOT EXCEED 2% IN ANY DIRECTION.

NOTE:

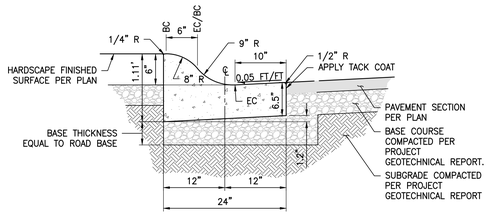
ADJACENT ROADWAY NOT SHOWN FOR CLARITY.



TRANSITION SECTION OF ROLLED CURB TO VERTICAL CURB

NOTE:

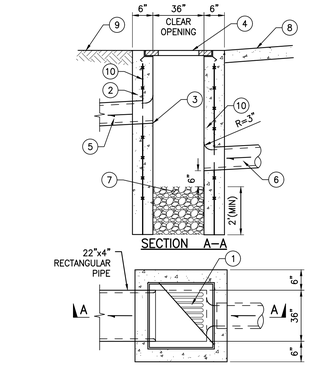
1. THE CURBS, GUTTERS AND SIDEWALKS SHALL HAVE DUMMY (3/8" x 1 1/2") JOINTS AT INTERVALS OF NOT GREATER THAN 10'-0".
2. CEMENT CONCRETE SHALL BE CLASS B.



ROLLED CONCRETE CURB AND GUTTER

5 6" ROLLED CONCRETE CURB AND GUTTER [18" OR 24" OR 30"]

N.T.S.



LEGEND:

1. GALVANIZED FRAME AND GRATE, ALHAMBRA FOUNDRY CO., OR APPROVED EQUIVALENT. SIZE AND GRATE BEARING PER PLAN.
2. PORTLAND CEMENT CONCRETE. (f'c = 4000 psi)
3. INVERT ELEVATION PER PLAN.
4. TOP OF GRATE. SEE PLAN FOR ELEVATION.
5. OUTLET RECTANGULAR PIPE, SIZE PER PLAN.
6. INLET PIPE, WHERE OCCURS. SIZE PER PLAN.
7. OPEN–GRADED GRAVEL FILL, APPROX. 1/2" DIA.
8. FINISH SURFACE PER PLAN.
9. FINISH GRADE/SURFACE PER PLAN.
10. CATCH BASIN WALLS AND FLOOR TO BE REINFORCED WITH 4x4–6–6 WELDED WIRE MESH.

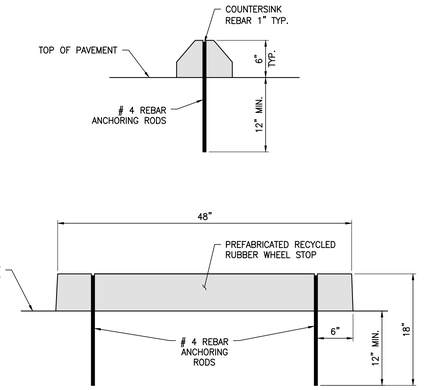
NOTES:

PRECAST CONCRETE CATCH BASIN WILL ALSO BE ACCEPTABLE. PROVIDE PRODUCT DATA TO CIVIL ENGINEER FOR APPROVAL.

3

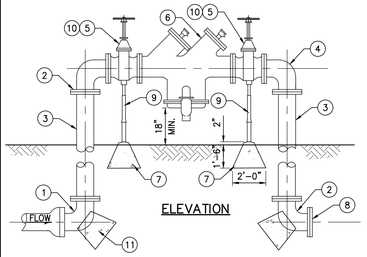
9 CAST–IN–PLACE CONCRETE CATCH BASIN

N.T.S.



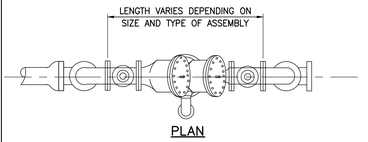
2 4' LONG PREFABRICATED RECYCLED RUBBER WHEEL STOP

N.T.S.



MATERIAL

1. 90° D.I. ELL x PUSH–ON
2. 90° D.I. ELL FLG x FLG
3. D.I. SPOOL FLG x FLG
4. 90° D.I. ELL FLG x FLG
5. U.S.C.–APPROVED SHUT–OFF VALVES. SEE SPECIFICATIONS
6. APPROVED REDUCED PRESSURE DEVICE (SEE PLAN FOR SIZE)
7. CONCRETE FOOTING
8. TEMPORARY D.I. BLIND FLANGE, AS REQUIRED
9. GALVANIZED ADJUSTABLE PIPE SUPPORT, PER MANUFACTURER'S RECOMMENDATION.
10. TAMPER SWITCH WIRED TO FIRE ALARM CONTROL PANEL, WHEN APPLICABLE.
11. THRUST BLOCK.

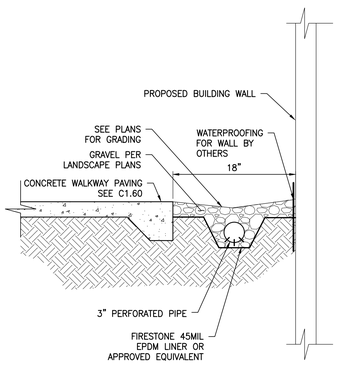


NOTES:

1. INSTALLATION SHALL COMPLY WITH THE LATEST PLUMBING CODES AND APPLICABLE LOCAL AGENCY REQUIREMENTS.
2. THRUST BLOCKS SHALL BE SIZED PER DETAIL SHOWN HEREON.
3. USE LEAD–FREE MODEL FOR ALL DOMESTIC WATER LINES.

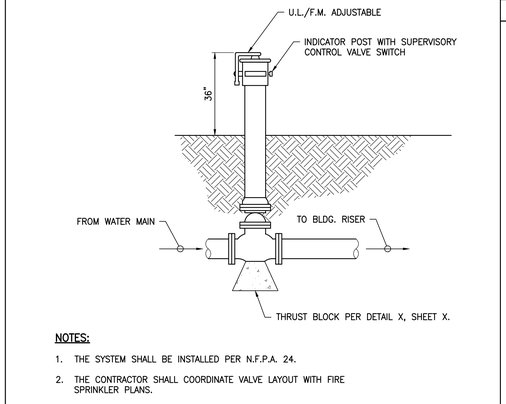
1 TYPICAL REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY

N.T.S.



10 3" PERFORATED PIPE

N.T.S.

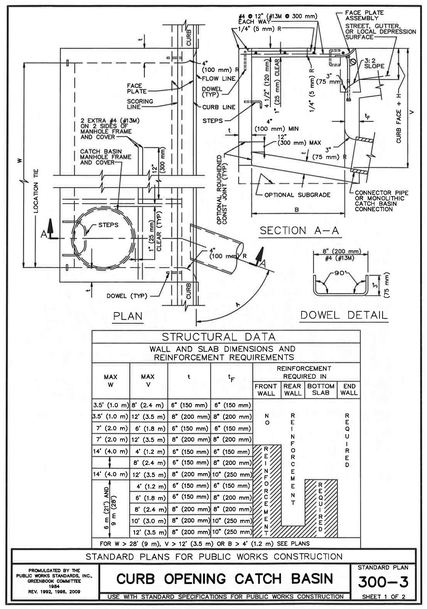


NOTES:

1. THE SYSTEM SHALL BE INSTALLED PER N.F.P.A. 24.
2. THE CONTRACTOR SHALL COORDINATE VALVE LAYOUT WITH FIRE SPRINKLER PLANS.

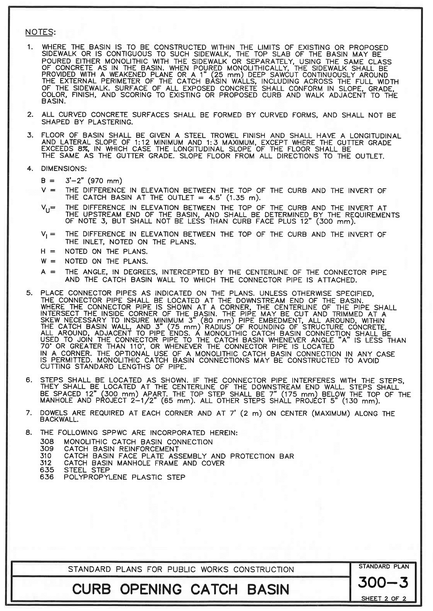
4 POST INDICATOR VALVE

N.T.S.



3 CURB OPENING CATCH BASIN

N.T.S.



3 CURB OPENING CATCH BASIN

N.T.S.

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Telephone 310.557.7600

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NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SS | REVIEW BY: SV

HGA NO: 3584-001-00

CIVIL DETAILS

DATE: JULY 06, 2017

C5.02

ADDENDA PACKAGE

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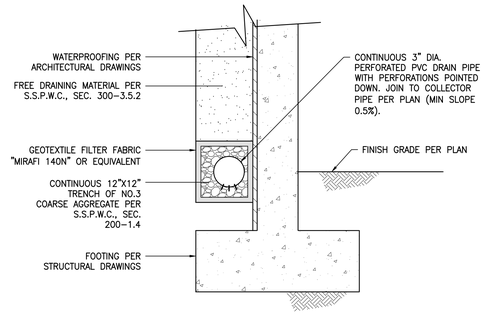
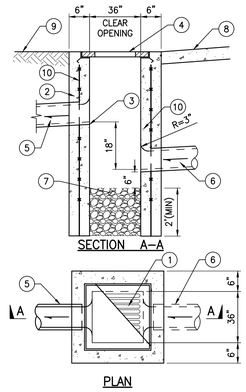


3 FOOTING DRAIN WITH CONTINUOUS PERFORATED DRAIN N.T.S.

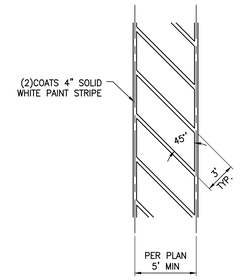


LEGEND:

1. GALVANIZED FRAME AND HEEL PROOF GRATE, ALHAMBRA FOUNDRY CO., OR APPROVED EQUIVALENT. SIZE AND GRATE BEARING PER PLAN.
2. PORTLAND CEMENT CONCRETE. (f'c = 4000 psi)
3. INVERT ELEVATION PER PLAN.
4. TOP OF GRATE. SEE PLAN FOR ELEVATION.
5. OUTLET PIPE, SIZE PER PLAN.
6. INLET PIPE, WHERE OCCURS. SIZE PER PLAN.
7. OPEN-GRADED GRAVEL FILL, APPROX. 1/2" DIA.
8. FINISH SURFACE PER PLAN.
9. FINISH GRADE/SURFACE PER PLAN.
10. CATCH BASIN WALLS AND FLOOR TO BE REINFORCED WITH 4x4-6-6 WELDED WIRE MESH.

NOTES:
PRECAST CONCRETE CATCH BASIN WILL ALSO BE ACCEPTABLE. PROVIDE PRODUCT DATA TO CIVIL ENGINEER FOR APPROVAL.

2 TEMPOPARY STORM WATER PRETREATMENT STRUCTURE N.T.S.



1 CROSSWALK STRIPING N.T.S.

HGA
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 S. FLOWER ST., #2100
LOS ANGELES, CA 90017
213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE
RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF CALIFORNIA.

NAME: Reza Rezaian
EXPIRATION DATE: 9/30/2017
REGISTRATION NUMBER: C62048

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: SS REVIEW BY: SV

HGA NO: 3584-001-00

CIVIL DETAILS

DATE: JULY 06, 2017

C5.03

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MATERIAL IDENTIFICATION CODES

SPEC SECTION	ABBREV.	DESCRIPTION
061000	AB	**AIR BARRIER**
		AB-1: Fluid applied, vapor permeable membrane air barrier
095100	ACT	**ACOUSTIC CEILING TILE**
		ACT-1: Removed from project.
		ACT-2: Armstrong Fine Fissured, 24"x48", tegular edge, 9/16" grid
		ACT-3: Armstrong, Soundscape Shapes, 48" x 48" x 7/8"
		ACT-4: Armstrong, MetalWorks, Finish: M15 Perforation, Color: Effects Oak, Custom Installation
		ACT-5: Armstrong, Woodworks Linear, Color: Oak
061000	AF	**ASPHALT FELT**
		AF-1: 15# Asphalt Felt
	AFS	**ALUMINUM FRAMING SYSTEM**
084114		AFS-1: Interior window wall (2" x 4.5"), center glazed for 1/4" glass. Basis of Design: Arcadia AR450 Series, Color: PT-5D
084114		AFS-1A: Interior window wall (2" x 4.5"), center glazed for 1" glass. Basis of Design: Arcadia AR450 Series, Color: PT-5D
084113		AFS-2: Exterior storefront (2-1/4" x 6"), front glazed for 1" glass. Basis of Design: Arcadia TC670 Series, Color to match PPG UC121215 Duranar Dark Gray
083100	AP	**ACCESS PANEL**
		AP-1: Non-rated, flush metal, Color to match wall or ceiling (provide as needed for access)
		AP-2: Fire-rated, recessed door with gypsum panel insert, Color to match wall or ceiling (provide as needed for access)
		AP-3: Non-rated, recessed door with gypsum panel insert, Color to match wall or ceiling (provide as needed for access)
098413	ASB	**ACOUSTICAL SONIC BAFFLES**
		ASB-1A: Acousticas sonic baffles, 6" dia., varying lengths, Integrated Custom Color: PT-4C
		ASB-1B: Acousticas sonic baffles, 6" dia., varying lengths, Integrated Custom Color: Dunn-Edwards, DET421, Le Corbusier Crush, Finish: flat
		ASB-1C: Acousticas sonic baffles, 6" dia., varying lengths, Integrated Custom Color: Dunn-Edwards DET449, Citrus Notes Finish: flat
098413	AWP	**ACOUSTICAL WALL PANEL**
		AWP-1: Removed from project.
		AWP-2: 1-1/8" thick, fabric wrapped panel (Decoustics Type HIR), installation: wrapped on site, fabric: FABRIC-1. See elevations for dimensions.
		AWP-3: 1-1/8" thick, fabric wrapped panel (Decoustics Type HIR), installation: wrapped on site, fabric: FABRIC-2. See elevations for dimensions.
		AWP-4: 1-1/8" thick, fabric wrapped panel (Decoustics Type HIR), installation: wrapped on site, fabric: FABRIC-3. See elevations for dimensions.
		AWP-5: 1-1/8" thick, fabric wrapped panel (Decoustics Type HIR), installation: wrapped on site, fabric: FABRIC-4. See elevations for dimensions.
102813	BA	**BUILDING ACCESSORIES**
		BA-2: Mop and broom holder with shelf, length 36"
083324	CD	**COILING DOOR (OVERHEAD)**
		CD-1: 90 min. fire-rated, prefinished, motorized, Basis of Design: Cookson FDO-A Auto Test Motor
054000	CEM SHTG	**CEMENT BOARD SHEATHING**
		CEM SHTG-1 Not used
102813	CH	**COAT HOOK**
		CH-1: Single coat hook
		CH-2: Double coat hook
042000	CMU	**CONCRETE MASONRY UNIT**
		Decorative Concrete Masonry Units
		CMU-11: Burnished, normal weight units. Basis of Design: Orco Block, 4" T x 8" D x 16" W, Color: Black 100MW
		CMU-12: Burnished, normal weight units. Basis of Design: Orco Block, 4" T x 12" D x 16" W, Color: Black 100MW
074244	CPNL	**COMPOSITE PANEL SYSTEM**
		CPNL-1: Solid phenolic panels (ESR-1687), 3/8" thick, Trespa Meteon FR, exterior. Color: Carmine Red
		CPNL-2: Solid phenolic panels (ESR-1687), 3/8" thick, Trespa Virtuon, interior. Color: Elegant Oak
		CPNL-3: Solid phenolic panels (ESR-1687), 3/8" thick, Trespa Meteon Uni Colors, Finish: Diffuse, Color: Mid Grey Satin
		CPNL-4: Removed from project
096800	CPT	**CARPET**
		Roll Goods
		CPT-1: Tandus, Aniline #04733, color: Stonework #44206, custom Powerbond order (broadloom installation)
		CPT-2: Removed from project
096813	CPT	**CARPET TILE**
		CPT-50: Tandus, Geo Tile #00979, color: Charcoal #00154
108000	CRB	**CEDAR RAISED BED**
		CRB-1: Deep Root Cedar Raised Bed (exterior), Mfr: Gardener's Supply Co., Size: 48" x 96" x 15"
031500	CS	**CONCRETE SEALER**
		CS-2: 30% type
093000	CTA	**CERAMIC TILE ACCESSORIES**
		CTA-1: Schluter metal trim
093000	CTB	**CERAMIC TILE - BASE**
		CTB-1: Crossville, RetroActive, color: Empress White - RA A215-RA, size: 2" x 12", grout: 1/4", color: GR-1
093000	CTF	**CERAMIC TILE - FLOOR**
		CTF-1: Crossville, Shades, color: Ink UPS, size: 12" x 24", installation: see enlarged restroom plan, grout: GR-1
093000	CTW	**CERAMIC TILE - WALL**
		CTW-1: Crossville, RetroActive, color: Empress White - RA A215-RA, size: 3" x 12", grout: 1/4" GR-1, finish: unpolished and graffiti resistant
		CTW-2: Crossville, RetroActive, color: Empress White - RA A215-RA, size: 4" x 12", grout: 1/4" GR-1, finish: unpolished and graffiti resistant
		CTW-3: Crossville, RetroActive, color: Empress White - RA A215-RA, size: 6" x 12", grout: 1/4" GR-1, finish: unpolished and graffiti resistant
084400	CW	**CURTAIN WALL (GLAZED ALUMINUM)**
		CW-1: Pre-fabricated, field assembled, pressure plate, aluminum framing for 1" glass, 2-1/2" x 7" deep. Basis of Design: Arcadia T500 (OPG 2900 Series), Color to match PPG UC121215 Duranar Dark Gray
		CW-2: Pre-fabricated, field assembled, pressure plate, aluminum framing for 1" glass, 2-1/4" x 6" deep. Basis of Design: Arcadia T500 (OPG 6000 Series), Color to match PPG UC121215 Duranar Dark Gray
		CW-3: Pre-fabricated, Field assembled, pressure plate, fire-rated steel frame system for 1 5/8" glass (Pilkington Pyrostop), 2-3/8" x 8" deep. Basis of Design: Technical Glass Products (Fireframes Curtainwall Series) Color to match PPG UC121215 Duranar Dark Gray
101220	DWS	**DISPLAY WALL SYSTEM**
		DWS-1: Display Case (recessed), MFR: Poblocki, Size: 48" x 96" x 20"
		DWS-2: Display Case (recessed), MFR: Poblocki, Size: 48" x 96' x 10"
108000	EVAC	**EMERGENCY EVACUATION CHAIR**
		EVAC-1: Emergency Evacuation Chair with storage cabinet, MFR: Stryker, Model #: 6254, Cabinet Color: TBD
064000	FABRIC	**FABRIC**
		FABRIC-1: Maharam, Study, color: 466269-003, Solarium
		FABRIC-2: Maharam, Dapper, color: 466316-021 Very
		FABRIC-3: Luna Textiles, Hardcopy color: HCY-5535, Ringer
		FABRIC-4: Maharam, Mimic color: 466136-016, Laser
096613	FDS	**FLOOR DIVIDER STRIP (TERRAZZO)**
		FDS-1: 1/8" zinc
104400	FE	**FIRE EXTINGUISHER**
		FE-4: 10 lbs extinguisher on wall bracket
		FE-5: Not used
104400	FEC	**FIRE EXTINGUISHER CABINET**
		FEC-3: Semi-recessed, glass panel
079000	FGS	**FOAM GASKET SEAL**
		FGS-1: Open Cell foam
055000	FIN	**METAL FIN**
		FIN-1: Extruded Aluminum Fin, Size: 12" x 3" x 3/8" Finish to match MP-3B; Color to match MP-3B
078100	FP	**FIREPROOFING (Spray Fire Resistive Materials)**
		FP-1: Not used
		FP-2: Cementitious fireproofing, medium density (exposed)
		FP-3: Not used
078443	FRJS	**FIRE RESISTIVE JOINT SYSTEM**
		FRJS-1: Head of interior partitions
		FRJS-2: Edge of slab to curtain wall
		FRJS-3: Exterior stud walls
064400	FRP	**FIBERGLASS REINFORCED PANEL**
		FRP-1: (4x8 sheet, textured surface, color white)
061000	FRT	**FIRE RETARDANT TREATED**
		FRT-1: Fire retardant treated wood materials
078400	FSTOP	**FIRESTOPPING**
		FSTOP: Thru-penetration fire stops at all locations, except slab edges
104400	FVC	**FIRE VALVE CABINET**
		FVC-1: Recessed with glass door
055000	GATE	**SLIDING METAL GATE**
		GATE-1: Sliding metal gate
102813	GB	**GRAB BARS**
		GB-1: Stainless steel grab bars, 36" long
		GB-2: Stainless steel grab bars, 42" long
088000	GL	**GLASS, GLAZING**
		Monolithic Glass
		GL-1: Clear annealed glass, 1/4" unless otherwise indicated
		GL-1T: Tempered clear annealed glass, 1/4" unless otherwise indicated
		GL-1TL: Tempered, laminated clear annealed glass, 1/4" unless otherwise indicated
		Monolithic Back Painted Glass
		GL-6: LI BP Straight White (Lustre Finish) by GlasPro, 1/4"
		GL-7: Yellow by GlasPro, 1/4"
		GL-7T: Tempered, Yellow by GlasPro, 1/4"
		GL-8: True Fog White (Starphire) by GlasPro, 1/4"
		GL-8T: Tempered, True Fog White (Starphire) by GlasPro, 1/4"
		Laminated Monolithic Glass
		GL-15: Laminated, tempered, LI Super Red by GlassPro, 9/16"
		Insulated Glass
		GL-21: 1" Insulated, Low-e, Clear, 1/4", 1/2", 1/4", VRE1-65 HS/HS
		GL-21L: 1" Insulated, Low-e, Clear, laminated, 1/4", 1/2", 1/4", VRE1-65 HS/HS
		GL-21T: 1" Insulated, Low-e, clear, tempered, 1/4", 1/2, 1/4", VRE1-65 HS/HS
		GL-23: 1" insulated, fritted screen, Low-e, 1/4", 1/2", 1/4"
		GL-23L: 1" insulated, fritted screen, Low-e, laminated, 1/4", 1/2", 1/4"
		GL-24T: 5/8" insulated (for GreenHouse), Mfr:International Green House
		Spandrel Glass
		GL-41: 1" clear, insulated unit with ceramic frit 1/4", 1/2", 1/4", Color to match ICD #1-0016 Charcoal
		GL-41L: 1" clear, insulated unit with ceramic frit, laminated 1/4", 1/2", 1/4", Color to match ICD #1-0016 Charcoal
		GL-41T: 1" clear, insulated unit with ceramic frit, tempered 1/4", 1/2", 1/4", Color to match ICD #1-0016 Charcoal
		GL-41TL: Not used
		Fire-Rated Glazing
		GL-62: Laminated, 45 min. fire-rated and impact safe-rated unit, 5/16"
		GL-63: Laminated, 60 min. fire-rated unit, 1-5/8"
055000	GRL	**GRILLE (ARCHITECTURAL)**
		GRL-1: Not used
		GRL-2: Not used
064000	GROM	**GROMMET**
		GROM-1: Not used
		GROM-2: Computer cable grommet, rectangular 2" by 4"
093000	GR	**GROUT**
		GR-1: Polymer-modified tile grout, Mapei, Color: Charcoal
		GR-2: Removed from project
055000	GRT	**METAL GRATING**
		GRT-1: Not used
092900	GYP BD	**GYPSUM BOARD**
		5/8" Gypsum Panels
		GYP BD-1: 5/8" fire-rated type "X" wallboard
		GYP BD-2: 5/8" fire-rated type "X" water-resistant wallboard
		1/2" Gypsum Panels
		GYP BD-11: Not used
		GYP BD-14: Not used
		Special Gypsum Panels
		GYP BD-21: 1" shaft liner
		GYP BD-25: Not used
		GYP BD-26: Not used
		GYP BD-35: Not used
		GYP BD-36: 5/8" impact-resistant gypsum board
092913	GYP SHTG	**GYPSUM SHEATHING**
		GYP SHTG-1: Not used
		GYP SHTG-2: 5/8" type "X" fiberglass faced gypsum sheathing (wall)
		GYP SHTG-3: Not used
		GYP SHTG-4: 5/8" fiberglass faced gypsum sheathing (roof)
092900	GYP TRIM	**GYPSUM BOARD TRIM & ACCESSORIES**
		GYP TRIM-1: Not used
		GYP TRIM-2: Not used
		GYP TRIM-3: Metal reveal
102813	HD	**HAND/HAIR DRYER**
		HD-1: Hand dryer, recessed, automatic activated
040519	HORIZ REINF	**HORIZONTAL WALL REINFORCEMENT**
		HORIZ REINF-1: Truss type
		HORIZ REINF-2: Ladder type
099600	HPC	**HIGH PERFORMANCE COATING**
		HPC-1: Epoxy primer, aliphatic urethane coating
072100	INSUL	**INSULATION**
		Rigid Insulation
		INSUL-1: Perimeter insulation (extruded polystyrene) for below grade
		INSUL-2: Rigid wall insulation (extruded polystyrene)
		INSUL-5: Not used
		Polyisocyanurate Insulation
		INSUL-15: Isocyanurate board insulation with foil facing
		Fiberglass/Mineral Wool Insulation
		INSUL-20: Unfaced fiberglass batt insulation
		INSUL-21 Not used
		INSUL-24: Mineral wool batt insulation
		INSUL-25: Curtain wall insulation
		Acoustical Insulation
092900		INSUL-40: Acoustical Batts (for use with interior stud walls)
108000	LKB	**LOCK BOX**
		LKB-1: Recessed aluminum lock box
089100	LVR	**LOUVER (METAL)**
		LVR-1: 4" deep, aluminum 2 coat fluoropolymer finish. Manufacturer: Airolite, Model K609. Color: To be selected by Architect (provide as needed)
040519	MA	**MASONRY ACCESSORIES**
		MA-1: Control joint filler
		MA-2: Deflection joint material
		MA-3: Column wrap
		MA-4: Bond breaker
072670	MB	**MOISTURE BARRIER**
		MB-1: Self-adhering cavity wall membrane (Permabarrier)
075216	MBIT	**MODIFIED BITUMEN ROOFING**
		MBIT-1: SBS modified bitumen roofing system
	MCW	**MANUFACTURED CASEWORK**
123213		MCW-2: Not used
123110		MCW-5: Not used
076210	MEMB FLASH	**MEMBRANE FLASHING (NON-EXPOSED LINERS)**
		MEMB FLASH-1: (Rubberized asphalt, self-adhering)
		MEMB FLASH-2: (EPDM, self-adhering)
055000	MET FAB	**METAL FABRICATION**
		MET FAB-1: Shop fabricated steel stair, steel pan concrete filled
		MET FAB-2: Interior steel ladder (elevator), painted
		MET FAB-8: Bollards, 5" dia. steel, removable. Manufacturer: Trafficguard Model TL 1004 R
		MET FAB-9: Bollards; 5" dia. steel, embedded in concrete. Manufacturer: Trafficguard Model RFP 4560 R
		MET FAB-10: Perforated Flat Metal, Manufacturer: McNichols, Color to match PT-5E
092216	MET FURG	**METAL FURRING (INTERIOR)**
		MET FURG-1: Hat channels
		MET FURG-2: Z-furring
		MET FURG-3: Cold-rolled steel channels
		MET FURG-4: Resilient furring channels
		MET FURG-5: Foam furring channel (U shaped) (thermal studs)
055000	MET RAIL	**METAL RAILING**
		MET RAIL-1: Not used
		MET RAIL-2: Not used
		MET RAIL-4: Not used
		MET RAIL-5: Not used
092216	MET STUD	**METAL STUD FRAMING SYSTEM (INTERIOR)**
		MET STUD-1: Non-load bearing, size as indicated, 20 GA.
		MET STUD-2: Shaft wall studs, gauge & SRE designed for rating & span
102813	MIR	**MIRROR (FRAMED)**
		MIR-1: Framed mirror w/o shelf, size as indicated, w / Johnson Defender Film
101100	MKBD	**MARKER BOARD**
		MKBD-1A: Dry-type marker board, low gloss, 5'x10'
		MKBD-1B: Dry-type marker board, low gloss, 5'x12'
		MKBD-1C: Dry-type marker board, low gloss, 5'x16'
		MKBD-1D: Dry-type marker board, low gloss, 4'x6'
		MKBD-1E: Dry-type marker board, low gloss, 4'x8'
		MKBD-1F: Dry-type marker board, low gloss, 4'x10'
		MKBD-1G: Dry-type marker board, low gloss, 4'x12'
		MKBD-1H: Dry-type marker board, low gloss, 4'x16'
	MP	**MANUFACTURED METAL PANEL**
074243		MP-1A: Composite aluminum panel with return, (4 mm) (wet sealed), Alpolic, Color: Mica MZG Grey (ESR-2653)
074243		MP-1B: Composite aluminum panel with return, (4 mm) (wet sealed), Alpolic, Color: Oer Red (ESR-2653)
074243		MP-1C: Composite aluminum panel with return, (4 mm) (wet sealed), Alpolic, Color: Matte Cloud White (ESR-2653)
074213		MP-2A: 1" thick, corrugated aluminum panels, horiz, exposed fasteners, Basis of Design: Morin VB 36 Color: Weathered Zinc (Mica)
074213		MP-2B: Removed from project
074213		MP-3A: 1" thick, panels, Basis of Design: SAF M-3000 Color to match Alpolic Mica MZG Grey
074213		MP-3B: 1" thick, panels, Basis of Design: SAF M-3000 Color to match Alpolic RRM Grey, Finish: Gloss
055000	MSA	**METAL SUPPORT ASSEMBLY**
		MSA-1: Supoort system for floor/ceiling hung equipment
064000	PLAM	**PLASTIC LAMINATE**
		PLAM-1: Removed from project
		PLAM-2: Wilsonart, plastic laminate to match WD-1
		PLAM-3 Pionite, Suede, Color: Ingot Gray SG211
		PLAM-4 Removed from project
		PLAM-5 Removed from project
	PLAS	**PLASTER**
092523		PLAS-11A: Exterior horizontal limestone plaster, 7/8" thick, metal lath. Basis of Design: Thermocromex, Tandour Finish, Integrated Color: #P75
092523		PLAS-11B: Exterior horizontal limestone plaster, 7/8" thick, metal lath. Basis of Design: Thermocromex, Tandour Finish, Integrated Color: #LM-17931
092400		PLAS-12: Exterior vertical portland cement plaster, 3/4" thick, metal lath. Color: To be selected by Architect
092400		PLAS-13: Exterior horiz portland cement plaster soffit, 3/4" thick, direct-applied to gypsum sheathing. Color: To be selected by Architect
092523		PLAS-14A: Exterior vertical limestone plaster, 7/8" thick, metal lath. Basis of Design: Thermocromex, Tandour Finish, Integrated Color: #P75
092523		PLAS-14B: Exterior vertical limestone plaster, 7/8" thick, metal lath. Basis of Design: Thermocromex, Tandour Finish, Integrated Color: #LM-17931
092400	PLTR	**PLASTER TRIM**
		PLTR-1: Stockton Aluminum Plaster Channel Screed, PCS, 3/4" wide
		PLTR-2: Stockton Aluminum Drip Screed, Vented, DS, 7/8 inch
061000	PPT	**PRESSURE PRESERVATIVE TREATED**
		PPT-1: Preservative treatment for wood
077233	PRC	**PREFABRICATED ROOF CURB**
		PRC-1 Not used
115213	PS	**PROJECTION SCREEN**
		PS-1 Removed from project
		PS-2 Removed from project
099000	PT	**PAINT**
		PT-1A: Dunn-Edwards, color: DEW382 Faded Grey, finish: Semi-Gloss
		PT-1B: Dunn-Edwards, color: DEW382 Faded Grey, finish: Gloss
		PT-1C: Dunn-Edwards, color: DEW382 Faded Grey, finish: Flat
		PT-1D: Dunn-Edwards, color: DEW382 Faded Grey, finish: Gloss Enamel
		PT-2A: Dunn-Edwards, color: DE6376 Looking Glass, finish: Semi-Gloss
		PT-2D: Dunn-Edwards, color: DE6376 Looking Glass, finish: Gloss Enamel
		PT-3A: Dunn-Edwards, color: DE5292 Acorn Squash, finish: Semi-Gloss
		PT-3C: Dunn-Edwards, color: DE5292 Acorn Squash, finish: Flat
		PT-4A: Dunn-Edwards, color: DET422 Attar of Rose, finish: Semi-Gloss
		PT-4C: Dunn-Edwards, color: DET422 Attar of Rose, finish: Flat
		PT-4D: Dunn-Edwards, color: DET422 Attar of Rose, finish: Gloss Enamel
		PT-4F: Dunn-Edwards, color: DET422 Attar of Rose, finish: High Performance (exterior use)
		PT-5D: Dunn-Edwards, color: DE6370 Legendary Gray, finish: Gloss Enamel
		PT-5E: Dunn-Edwards, color: DE6370 Legendary Gray, finish: Evershield Semi-Gloss
102813	PTC	**PAPER TOWEL CABINET**
		PTC-1: Recessed Automatic Paper Towel Dispenser and Waste Receptacle
		PTC-2: Semi-Recessed Automatic Paper Towel Dispenser
055000	RAIL	**RAILING (STAIR)**
		RAIL-3: Ext. exit stair handrail, 1.5" diameter steel pipe, wall-mounted or mounted to guardrail, stainless steel
		RAIL-4: Ext. exit stair guardrail, steel barstock painted PT-5
		RAIL-5: Interior stair handrail, 1.5" diameter steel pipe, wall mounted or mounted to guardrail, stainless steel
		RAIL-6: Interior stair guardrail, steel barstock painted PT-5
096500	RB	**RESILIENT BASE**
		RB-1: 4" rubber cove base, Johnsonite, Burnt Umber 63
		RB-2: 4" rubber non-cove base, Johnsonite, Burnt Umber 63
096500	RSF	**RESILIENT SHEET FLOORING**
		RSF-1: Forbo Marmoleum Fresco 3866 Eternity, thickness: 2.5mm
		RSF-2: Forbo Marmoleum Real 3139 Lava, thickness: 2.5mm
		RSF-3: Nora, Norament Round, color: Dust Grey
102813	SDISP	**SOAP DISPENSER**
		SDISP-1: Automatic Wall-mounted Soap Dispenser
079000	SLNT	**SEALANT**
		SLNT: Sealant Schedule - Refer to Specifications
076210	SMF	**SHEET METAL FLASHING AND TRIM**
		SMF-1: Prefinished galvanized steel
		SMF-2: Not used
102813	SNC	**SANITARY NAPKIN CABINET (VENDING)**
		SNC-1: Recessed Napkin/ Tampon Vendor
102813	SND	**SANITARY NAPKIN DISPOSAL**
		SND-1: Surface-mounted Sanitary Napkin Disposal
078700	SMOK	**SMOKE CONTAINMENT SYSTEM**
		SMOK-1: Smoke containment system
064000	SSF	**SOLID SURFACE FABRICATION**
		SSF-1: Corian, Color: Silver Birch @ Restrooms
		SSF-2: LG, Color: T017 Andromeda
		SSF-3: Corian, color: Royal Red @ Custom Seating
054000	STL FURG	**STEEL EXTERIOR FURRING (EXTERIOR)**
		STL FURG-1: Hat channels, galvanized
		STL FURG-2: Z-furring, galvanized
054000	STL STUD	**STEEL STUD FRAMING SYSTEMS (EXTERIOR)**
		STL STUD-1: Structural steel studs, 16 ga. galv, typical
102113.19	T COMP	**TOILET COMPARTMENTS**
		T COMP-7: In Pro, Bio Prism, color: Meteorite
096623	TER	**TERRAZZO**
		TER-3: Epoxy terrazzo floor. Color: White (Custom Mixture: #10049-1-Z), divider strip: <FDS-1>
		TER-4: Epoxy terrazzo floor. Color: Red (custom mixture TBD by Architect), divider strip: <FDS-1>
		TER-5: Precast epoxy terrazzo stair tread. Color: Red (custom mixture TBD by Architect), black epoxy abrasives < >
093000	THS	**THRESHOLD STRIP**
		THS-2: Marble at ceramic tile
101100	TKBD	**TACK BOARD**
		TKBD-1A: (Integrally colored synthetic cork in aluminum frame), Size: 6' X 6'
		TKBD-1B: (Integrally colored synthetic cork in aluminum frame), Size: 5' X 6'
		TKBD-1C: (Integrally colored synthetic cork in aluminum frame), Size: 4' X 6'
		TKBD-1D: (Integrally colored synthetic cork in aluminum frame), Size: 4' X 4'
		TKBD-1E: (Integrally colored synthetic cork in aluminum frame), Size: 3' X 6'
102813	TPH	**TOILET PAPER HOLDER**
		TPH-3: Removed from project
		TPH-4: Surface mounted double roll, for 2 stalls
075400	TPO	**THERMOPLASTIC SINGLE PLY ROOFING**
		TPO-1: Mech anchored, flat insulation with thermal barrier on metal deck
096500/ 096800/ 096813	TRS	**TRANSITION STRIP**
		TRS-1: Removed from project
		TRS-2: Carpet to resilient
		TRS-3: Concrete to resilient
		TRS-4: Terrazzo to resilient/carpet, metal transition strip
102813	TSC	**TOILET SEAT COVER DISPENSER**
		TSC-2: Surface mounted type
102813	US	**UTILITY SHELF**
		US-3: 8 deep, length 34", stainless steel
031500	UVB	**VAPOR BARRIER**
		UVB-3: 15 mil reinforced polyethylene sheet underfloor vapor retarder
072600	VR	**VAPOR RETARDER - WALLS**
		VR-1: Not used
097200 097210	VWC	**VINYL WALL COVERING**
		VWC-1: Custom Vinyl Wall Covering, Graphic: Custom Colored Graphic MFR: RIOT Creative Imaging
		VWC-1B: Removed from project
		VWC-1C: Removed from project
102226.10	VWS	**VERTICAL WALL SYSTEM**
		VWS-1: Automatic vertical folding acoustical wall system. Manufacturer: Skyfold Classic 51
102600	WCG	**WALL CORNER GUARD**
		WCG-4: Stainless steel cornerguard, 2"x 2" leg, recessed
064000	WD	**WOOD (TYPE AND FINISH)**
		WD-1: Hickory, quartersawn, clear coat
061000	WD BLKG	**WOOD BLOCKING**
		WD BLKG-1: Exposed or concealed wood blocking
061000	WD SHTG	**WOOD SHEATHING**
		Concealed Sheathing
		WD SHTG-1 Not used
		WD SHGT-3 Not used
		Roof and Miscellaneous
		WD SHTG-9: Exposed for paint, 3/4", FRT, exposure 2
	WP	**WATERPROOFING**
071326		WP-6: 60 mil. Self-adhering rubberized asphalt with polyethelene sheet
071416		WP-7: Not used
071616		WP-8: Crystalline waterproofing (Elevator Pit)
102600	WR	**WALL RAIL**
		WR-1: Inpro, product: 500 Wall Guard, color: Pewter Gray 0107
102813	WRC	**WASTE RECEPTACLE**
		WRC-1: Free standing waste
		WRC-2: Remove from project
092900	WRT	**WALL REVEAL TRIM**
		WRT-1: 1/2" reveal X 5/8" deep
		WRT-2: 3/4" reveal X 5/8" deep
		WRT-3: 2" reveal X 3/4" deep
	WT	**WINDOW TREATMENT**
122113		WT-1: Horizontal Blinds
		WT-2: Removed from project
122126		WT-3: MechoShade, Single Manual Shade, color: Charcoal, opening: 3%
122126		WT-4: MechoShade, Double Automatic Shades, color: TBD Black-Out, color: Dark Grey 0711 - opening: 3%
122126		WT-5: MechoShade, Double Manual Shades, color: TBD Black-Out, color: Dark Grey 0711 - opening: 3%

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LICENSED ARCHITECT – JAMES G. MATSON – C13036 – SEPTEMBER 30, 2019 RENEWAL DATE – STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: AD REVIEW BY:

HGA NO: 3584-001-00

MATERIAL ID CODES

DATE: JULY 06, 2017

A011

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AD

FIREPROOFING LEGEND

3

SECOND LEVEL FLOOR SLAB AND STRUCTURAL STEEL MEMBERS (COLUMNS, BEAMS, BRACING) THAT FALL WITHIN THE HATCHED AREA FROM SECOND LEVEL AND BELOW SHALL RECEIVE 1-HOUR <FP-2> FIREPROOFING PER THE FIREPROOFING SCHEDULE (UL NUMBERS PROVIDED). ANY STRUCTURAL STEEL MEMBER THAT LIES BELOW THE SECOND LEVEL FLOOR SLAB WITHIN THE HATCH REGION SHALL BE FIREPROOFED IN ITS ENTIRETY. STRUCTURAL MEMBERS AT THE EXTERIOR WALL SHALL BE INCLUDED. ALL COLUMNS THAT ARE TO RECEIVE <FP-2> FIREPROOFING MUST RECEIVE FIREPROOFING ALL THE WAY TO THE FOUNDATION.

THIRD LEVEL FLOOR SLAB AND STRUCTURAL STEEL MEMBERS (COLUMNS, BEAMS, BRACING) THAT FALL WITHIN THE HATCHED AREA FROM THIRD LEVEL AND BELOW SHALL RECEIVE 2-HOUR <FP-2> FIREPROOFING PER THE FIREPROOFING SCHEDULE (UL NUMBERS PROVIDED). ANY STRUCTURAL MEMBER THAT LIES BELOW THE THIRD LEVEL FLOOR SLAB WITHIN THE HATCH REGION SHALL BE FIREPROOFED IN ITS ENTIRETY. STRUCTURAL MEMBERS AT THE EXTERIOR WALL SHALL BE INCLUDED. ALL COLUMNS THAT ARE TO RECEIVE <FP-2> FIREPROOFING MUST RECEIVE FIREPROOFING ALL THE WAY TO THE FOUNDATION.

▲ 1 HOUR FIRE PROOFING ON PRIMARY STRUCTURAL MEMBERS

● 2 HOUR FIRE PROOFING ON PRIMARY STRUCTURAL MEMBERS

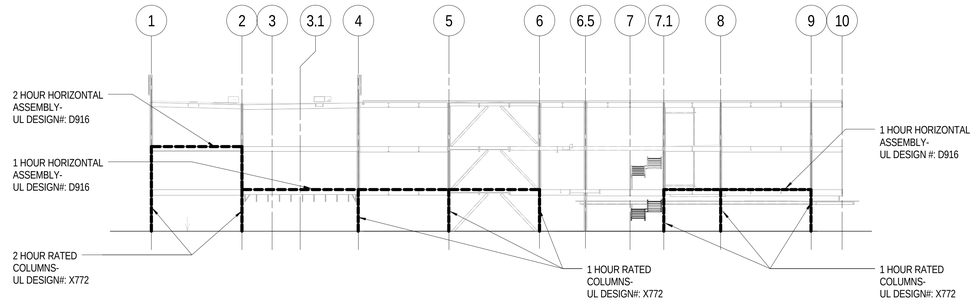
FIREPROOFING GENERAL NOTES

A. BRACE FRAMING MEMBERS ARE NOT REQUIRED TO RECEIVE FIREPROOFING.
B. EXTEND FIREPROOFING 3'-0" MIN. BEYOND AREA OF REQUIRED FIREPROOFING AT ALL PRIMARY STRUCTURAL MEMBER CONNECTIONS, TYP.
C. FOR 1 HOUR RATED HORIZONTAL ASSEMBLY- UL DESIGN #D916
D. FOR 2 HOUR RATED HORIZONTAL ASSEMBLY-UL DESIGN #D916
E. REFER TO SPRAY-APPLIED FIREPROOFING SCHEDULE BELOW FOR RATED COLUMN REQUIREMENTS.

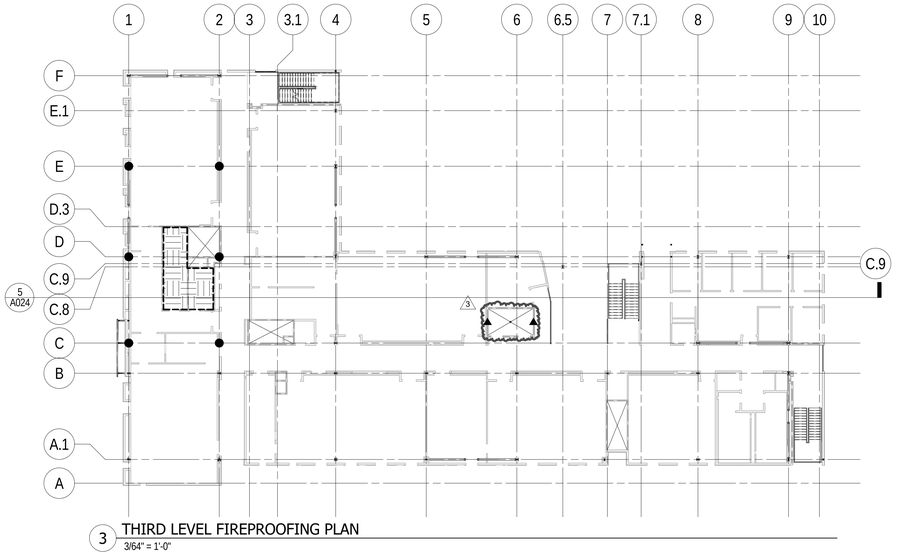
SPRAY-APPLIED FIREPROOFING SCHEDULE			1-HR.	2-HR.
STRUCTURAL MEMBER SECTION	TYPE	UL DESIGN #	MIN. THICKNESS	MIN. THICKNESS
I	STEEL W COLUMN	X772 Y715	5/8"	1-1/2"
I	STEEL W BEAM	N782	1/2"	3/4"
□	STEEL TUBE COLUMN / BEAM	Y710	3/4"	N/A

SEE <FP-2> ON MATERIAL ID LIST AND CORRESPONDING SPECIFICATION SECTION FOR MORE INFORMATION.

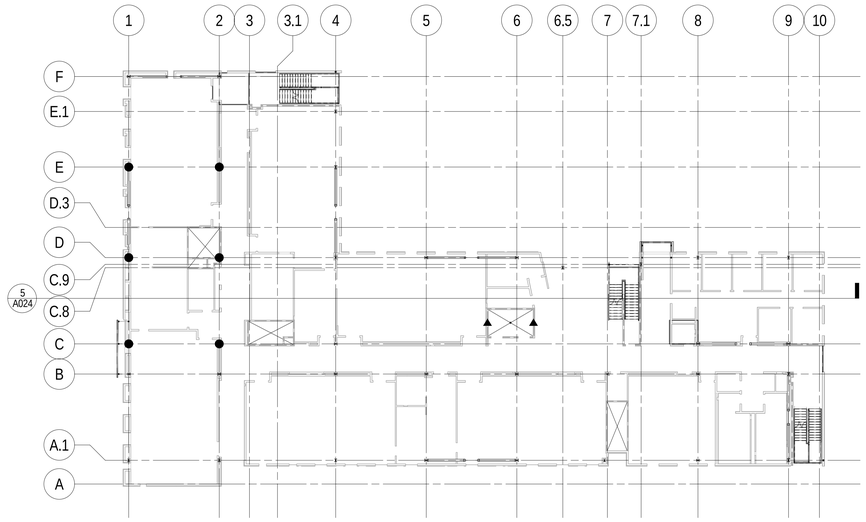
4 FIRE PROTECTION SCHEDULE / PLAN



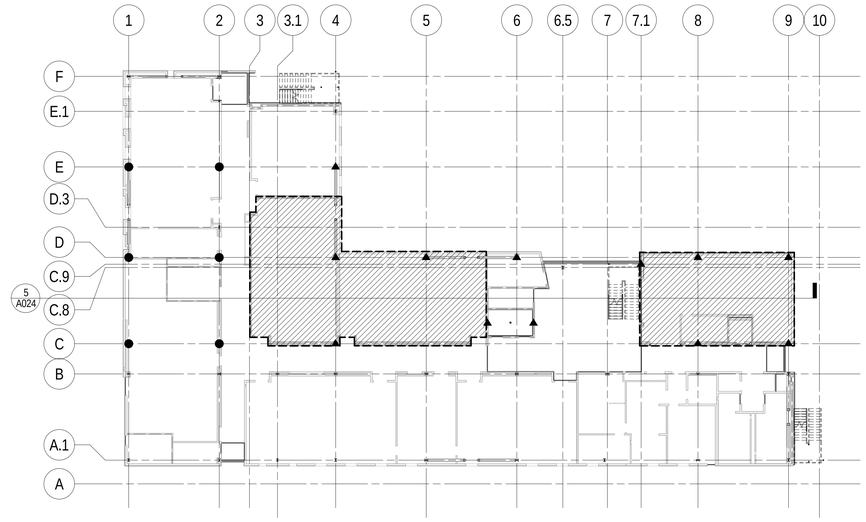
5 FIRE PROOFING SCHEDULE
3/64" = 1'-0"



3 THIRD LEVEL FIREPROOFING PLAN
3/64" = 1'-0"



2 SECOND LEVEL FIREPROOFING PLAN
3/64" = 1'-0"



1 FIRST LEVEL FIREPROOFING PLAN
3/64" = 1'-0"

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JAMES G. MATSON — LICENSED ARCHITECT — SEPTEMBER 30, 2017 RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: TE

HGA NO: 3584-001-00

FIREPROOFING PLAN

DATE: JULY 06, 2017

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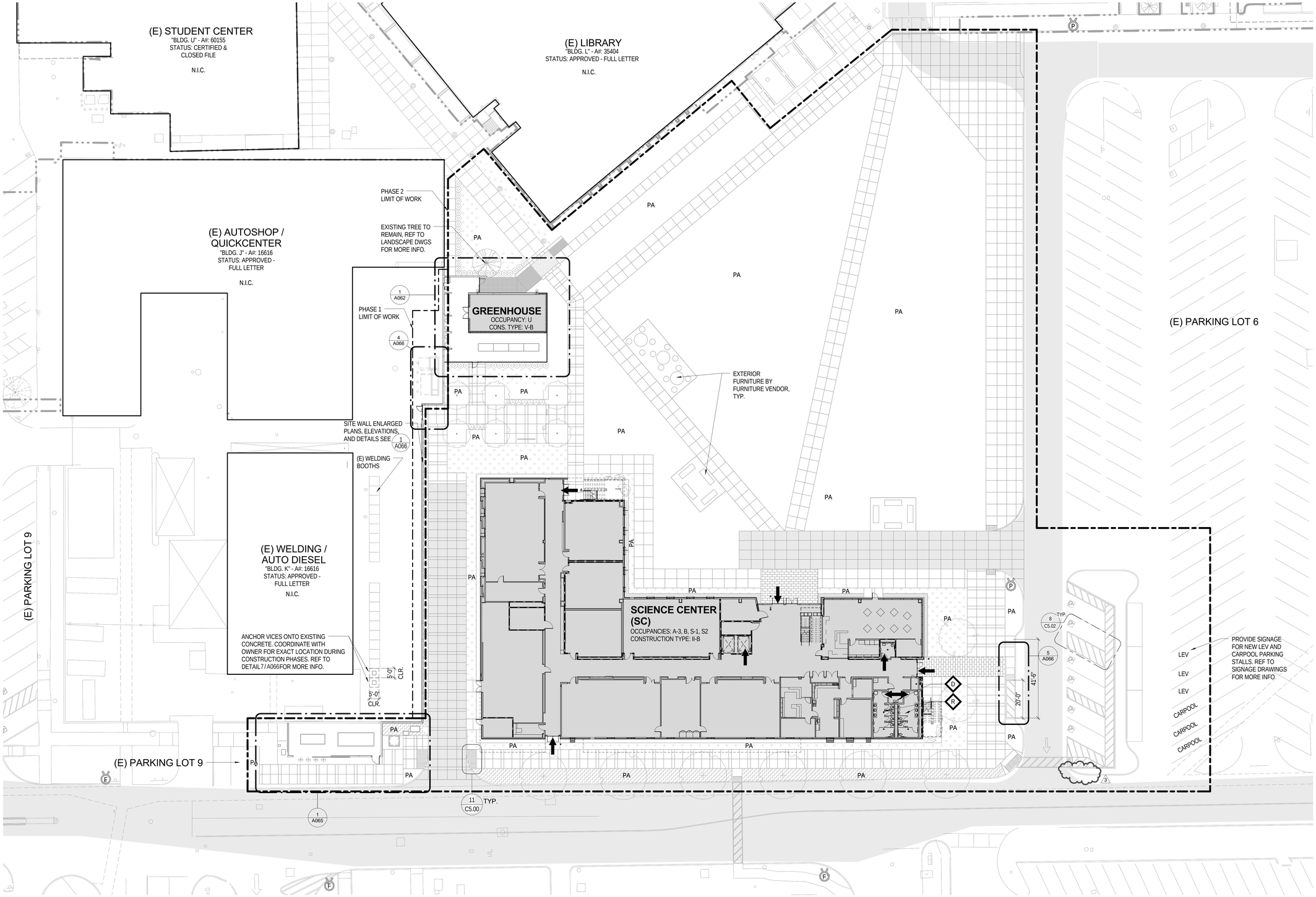

1 SITE PLAN ENLARGED
1" = 20'-0"

SITE LEGEND

	FIRE ACCESS	D	DRINKING FOUNTAIN ALONG P.O.T.
PA	PLANTER AREA	R	RESTROOMS ALONG P.O.T.
	LIMIT OF WORK	F	EXISTING FIRE HYDRANT
	DETECTABLE WARNING MIN. 3'-0" IN DIRECTION OF TRAVEL WHERE OCCURS (TYP.)	P	PROPOSED FIRE HYDRANT
		LEV	PARKING STALL FOR LOW EMITTING VEHICLE
	POINT OF ACCESS	CARPOOL	PARKING STALL FOR CARPOOL VEHICLE

PARKING LOT ANALYSIS - # OF SPACES PER LOT

		COMPACT	REGULAR	ACCESSIBLE	VAN ACCESSIBLE	TOTAL	DELTA
LOT #6	EXISTING	0	674	15	11	700	
	NEW	3	463	15	11	489	-208
LOT #9	EXISTING	0	35	5	1	41	
	NEW	0	16	5	1	22	-19

NOTE: CONSTRUCTION PHASING PER OWNER REQUIREMENTS.

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JAMES G. MATSON — LICENSED ARCHITECT — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA — EXPIRATION 31-2019

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

ENLARGED ARCHITECTURAL SITE PLAN

DATE: JULY 06, 2017

A061

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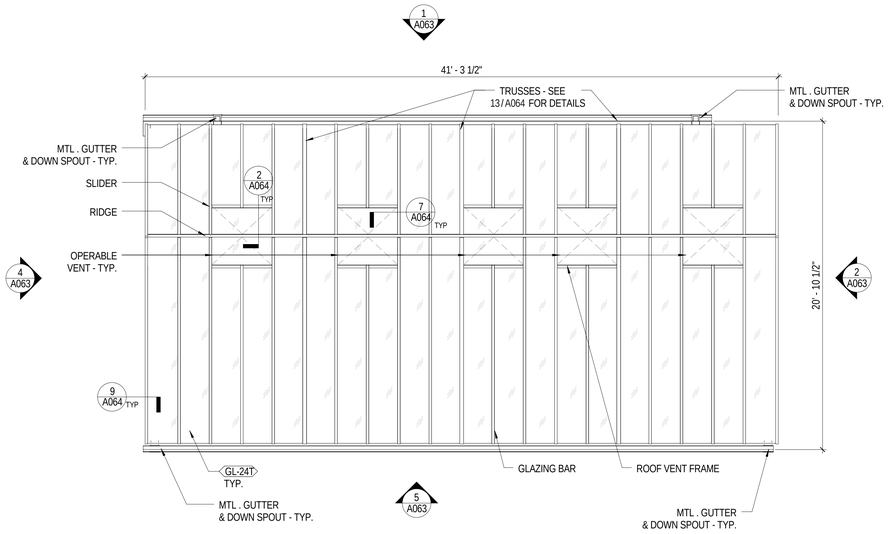
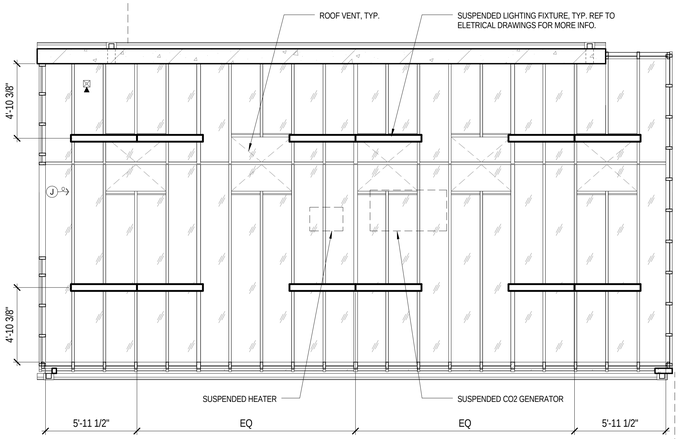
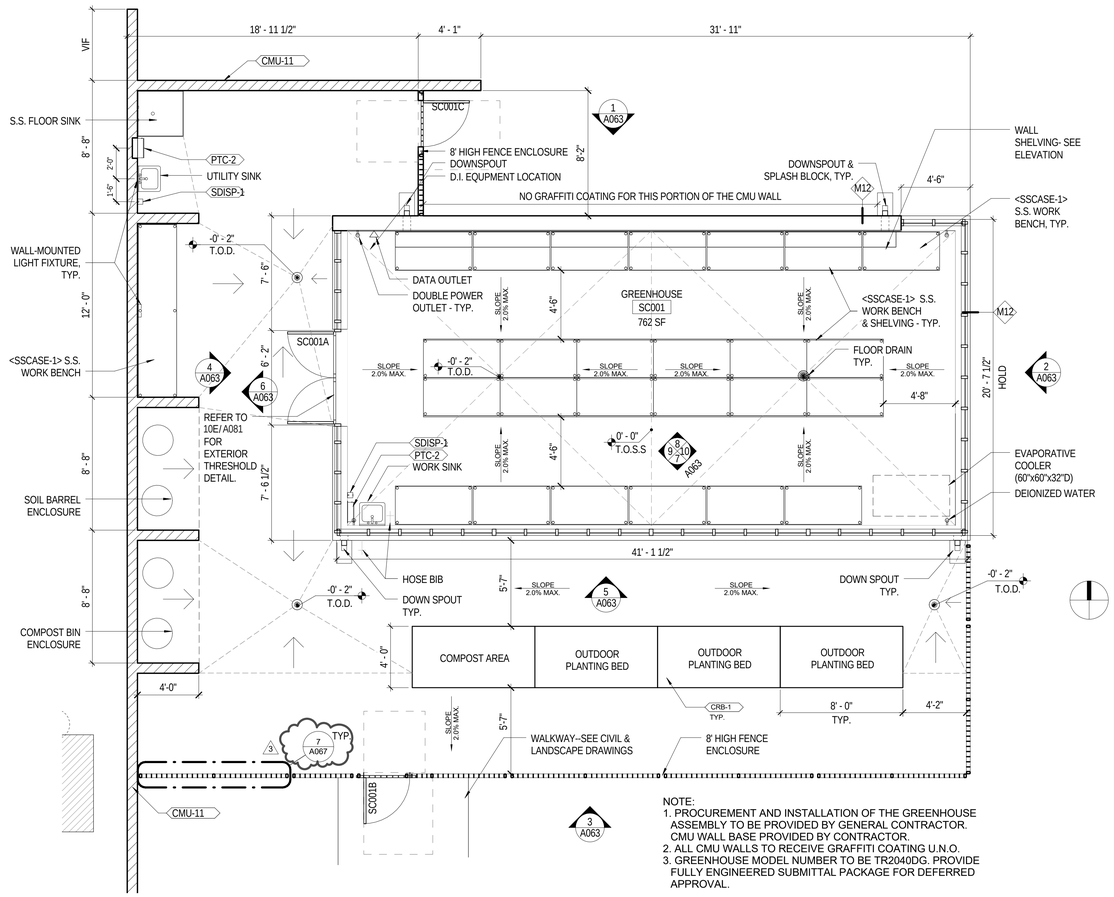


6 GREENHOUSE - ROOF PLAN
1/4" = 1'-0"



NOTE: ANCHORAGE DETAIL FOR SUSPENDED LIGHTING FIXTURE, SUSPENDED HEATER AND SUSPENDED CO2 GENERATOR IS REQUIRED AS PART OF DEFERRED SUBMITTAL.

2 GREENHOUSE - ENLARGED REFLECTED CEILING PLAN
1/4" = 1'-0"



NOTE:
1. PROCUREMENT AND INSTALLATION OF THE GREENHOUSE ASSEMBLY TO BE PROVIDED BY GENERAL CONTRACTOR. CMU WALL BASE PROVIDED BY CONTRACTOR.
2. ALL CMU WALLS TO RECEIVE GRAFFITI COATING U.N.O.
3. GREENHOUSE MODEL NUMBER TO BE TR2040DG. PROVIDE FULLY ENGINEERED SUBMITTAL PACKAGE FOR DEFERRED APPROVAL.

1 GREENHOUSE - ENLARGED PLAN
1/4" = 1'-0"

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REGISTERED ARCHITECT
JAMES G. MATSON
No. C13036
EXPIRATION 08.31.17
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

GREEN HOUSE - ENLARGED PLANS

DATE: JULY 06, 2017

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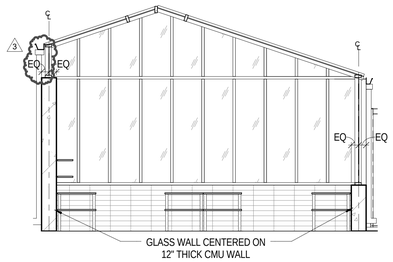
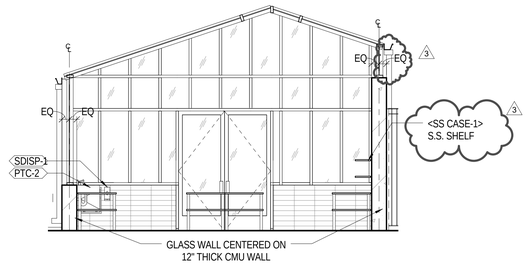
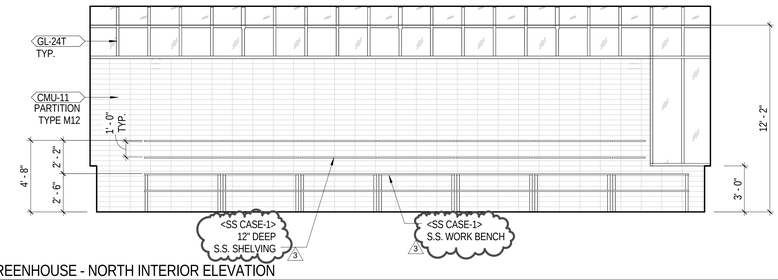


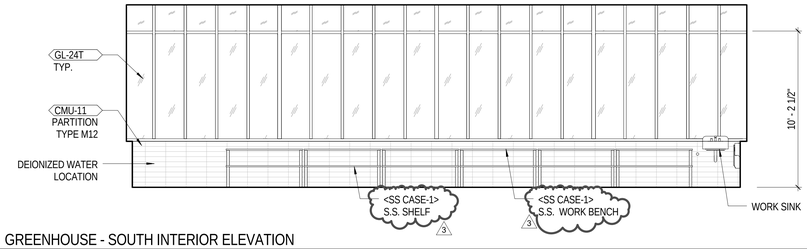
10 GREENHOUSE - EAST INTERIOR ELEVATION
1/4" = 1'-0"



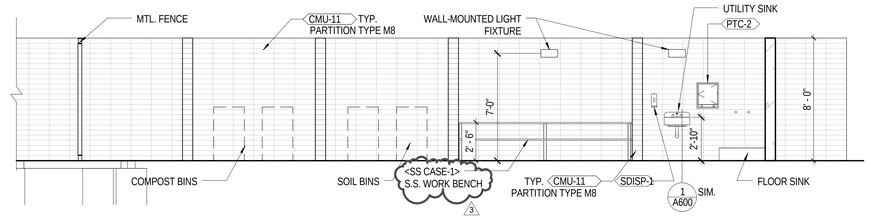
9 GREENHOUSE - WEST INTERIOR ELEVATION
1/4" = 1'-0"



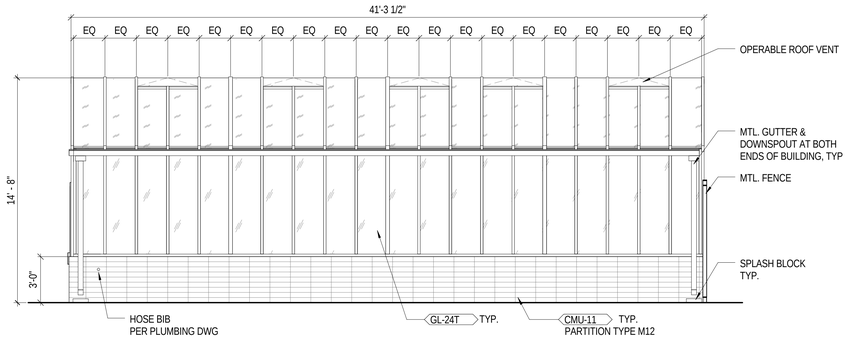
8 GREENHOUSE - NORTH INTERIOR ELEVATION
1/4" = 1'-0"



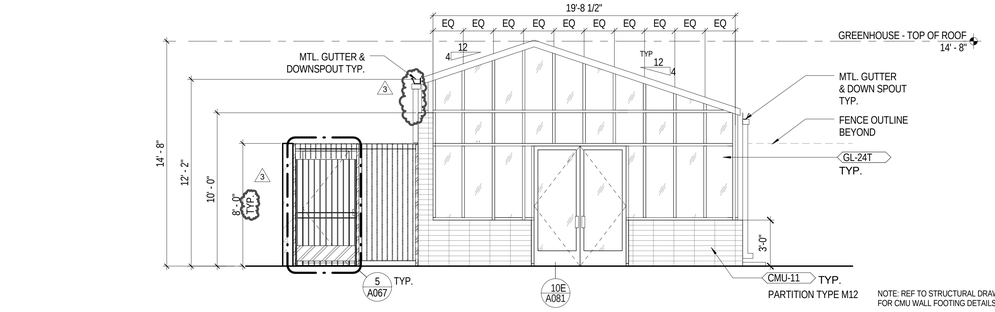
7 GREENHOUSE - SOUTH INTERIOR ELEVATION
1/4" = 1'-0"



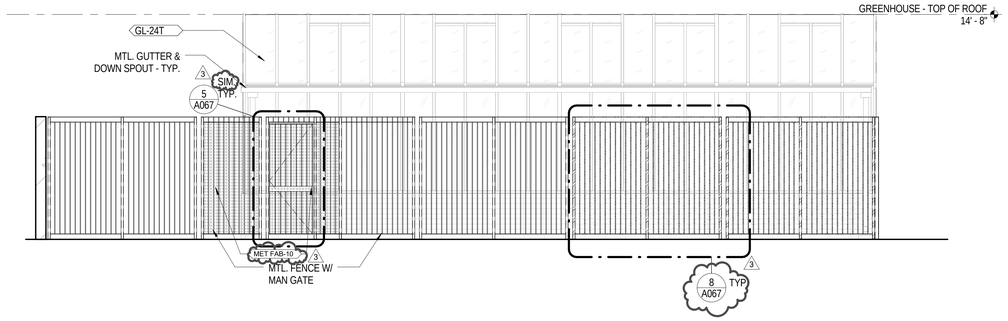
6 GREENHOUSE - WEST ELEVATION 2
1/4" = 1'-0"



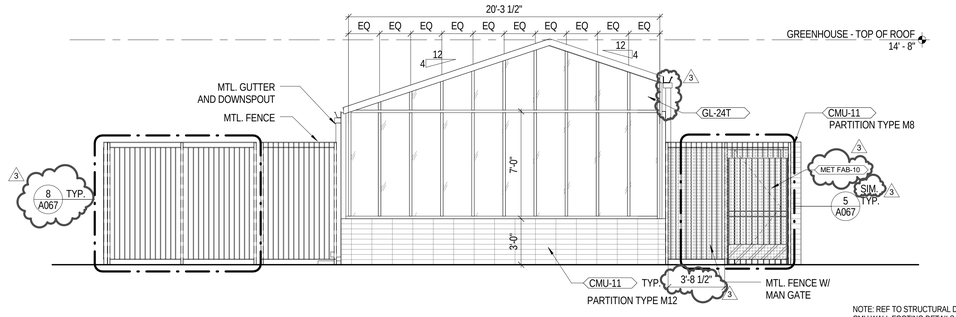
5 GREENHOUSE - SOUTH ELEVATION 2
1/4" = 1'-0"



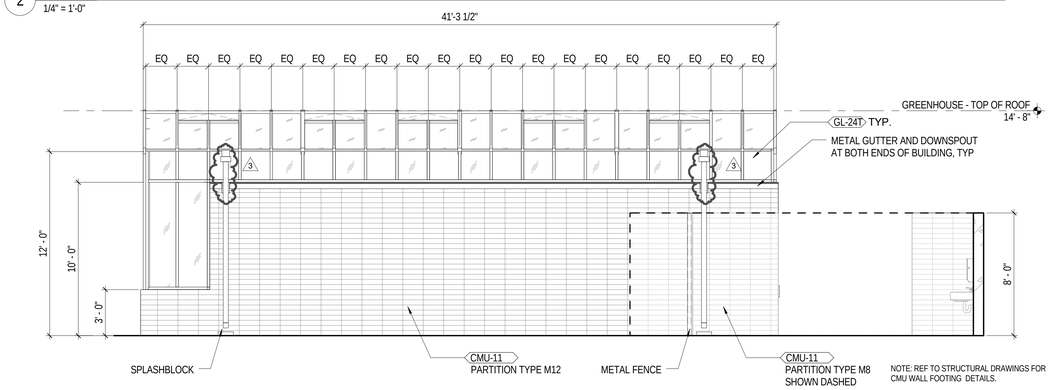
4 GREENHOUSE - WEST ELEVATION
1/4" = 1'-0"



3 GREENHOUSE - SOUTH ELEVATION
1/4" = 1'-0"



2 GREENHOUSE - EAST ELEVATION
1/4" = 1'-0"



1 GREENHOUSE - NORTH ELEVATION
1/4" = 1'-0"

hga.
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

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COMMUNITY COLLEGE
DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA
COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA

LICENSED ARCHITECT
JAMES G. MATSON
No. C13036
SEPTEMBER 30, 2019
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

GREEN HOUSE - ENLARGED ELEVATIONS

DATE: JULY 06, 2017

A063

ADDENDA PACKAGE

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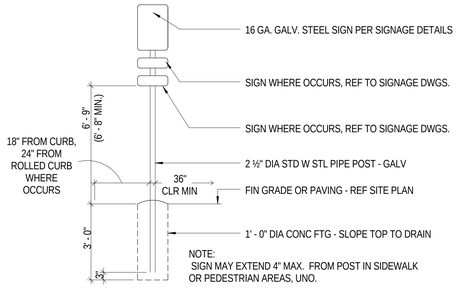
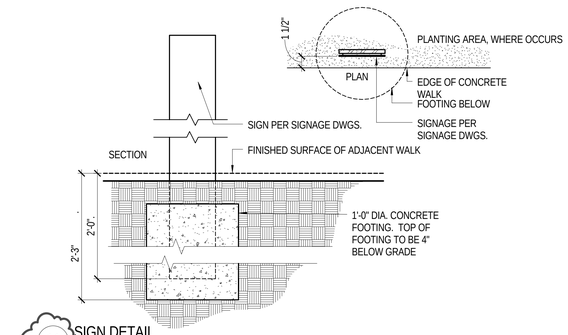
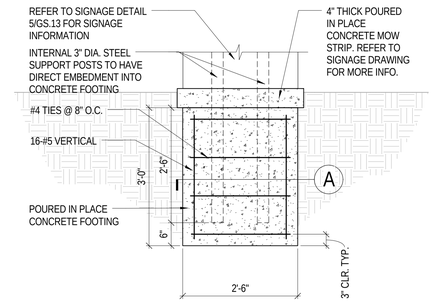
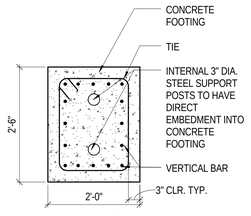


10 POLE MOUNTED SIGN DETAIL
3" = 1'-0"



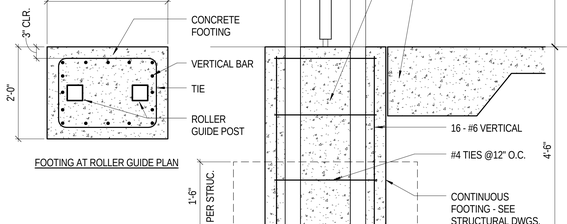
11 SIGN DETAIL
1 1/2" = 1'-0"



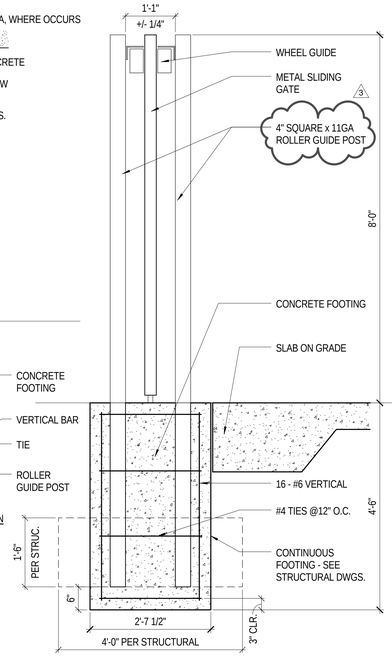


A FOOTING PLAN DETAIL AT SIGNAGE

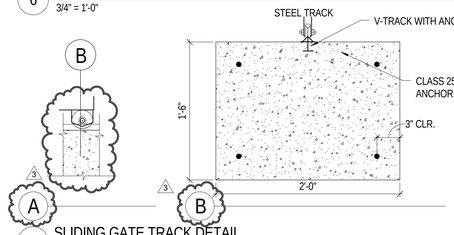
9 ANCHORAGE DETAIL AT DIRECTIONAL SIGN
3/4" = 1'-0"



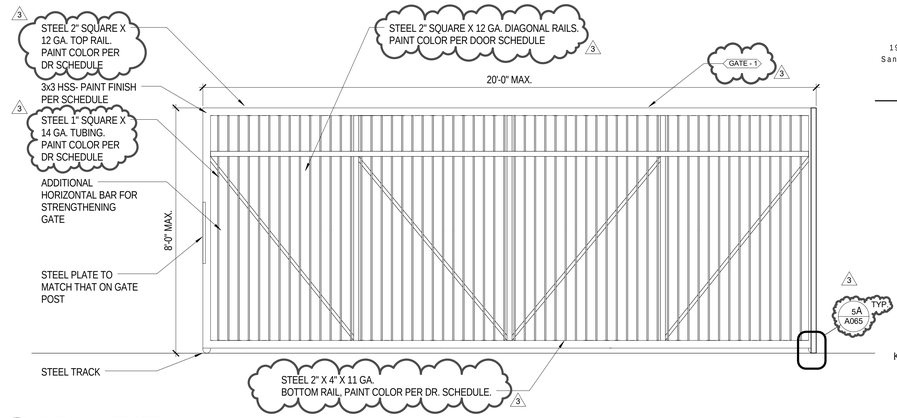
FOOTING AT ROLLER GUIDE PLAN



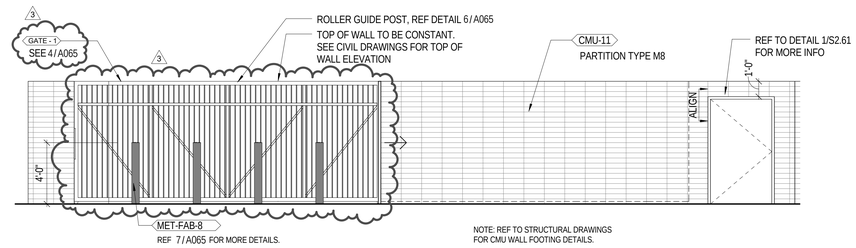
6 ROLLER GUIDE POST DETAIL
3/4" = 1'-0"



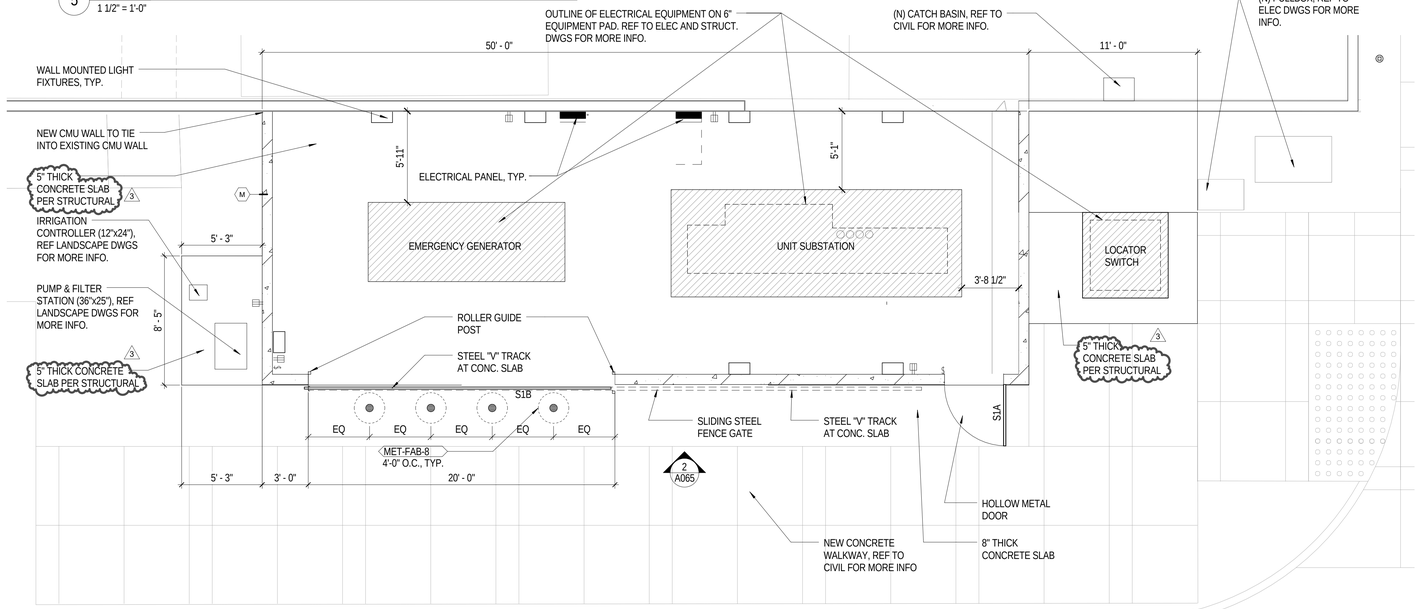
5 SLIDING GATE TRACK DETAIL
1 1/2" = 1'-0"



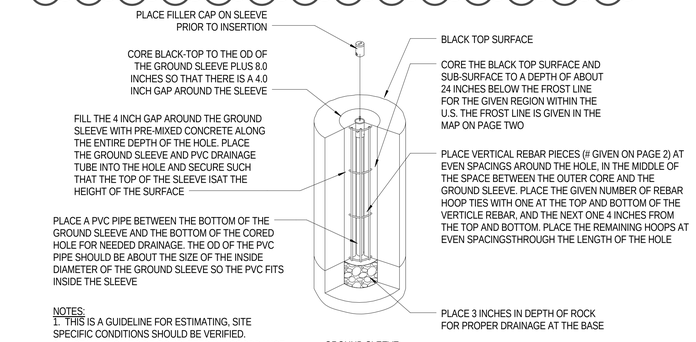
4 SLIDING GATE DETAIL
1/2" = 1'-0"



2 GENERATOR - SOUTH ELEVATION
1/4" = 1'-0"



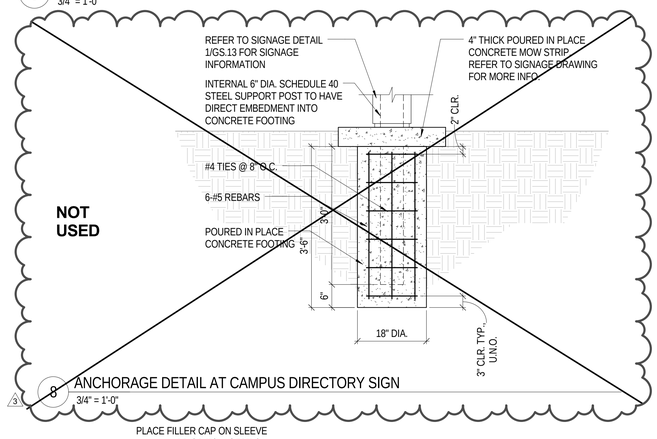
1 GENERATOR - ENLARGED PLAN
1/4" = 1'-0"



GROUND SLEEVE INSTALLATION FOR BLACK TOP SURFACES

NOTES:
1. THIS IS A GUIDELINE FOR ESTIMATING, SITE SPECIFIC CONDITIONS SHOULD BE VERIFIED.
2. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
3. ALL DIMENSIONS ARE CONSIDERED TRUE AND REFLECT MANUFACTURER'S SPECIFICATIONS.
4. DO NOT SCALE DRAWING.
5. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info REFERENCE NUMBER 4209-021A.

7 REMOVABLE BOLLARD DETAIL
1/2" = 1'-0"



8 ANCHORAGE DETAIL AT CAMPUS DIRECTORY SIGN
3/4" = 1'-0"

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Santa Monica, California 90405
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SANTA ANA, CA 92706

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: Approver

HGA NO: 3584-001-00

GENERATOR - ENLARGED PLAN AND DETAILS

DATE: JULY 06, 2017

A065 ADDENDA PACKAGE

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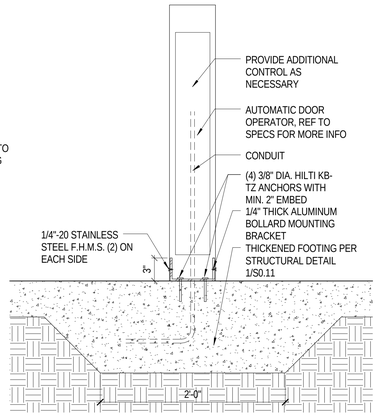
SK

COORDINATE WITH OWNER TO RELOCATE (E) VICES DURING CONSTRUCTION PHASES.

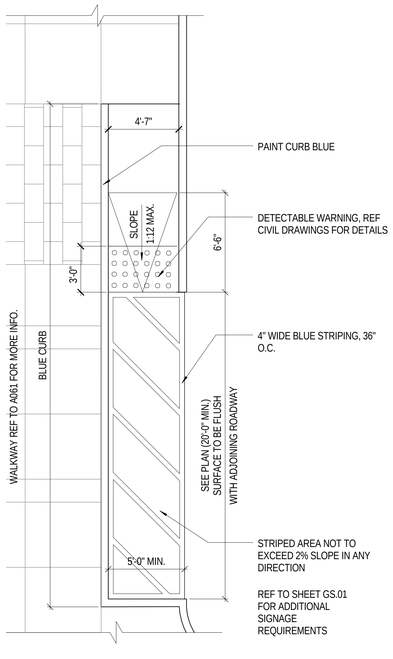
(E) 6" CONCRETE SLAB ON GRADE. V.I.F.

(4) 1/2" HILTI KB-TZ EXP ANCHOR (ICC ESR-1917) W/ 3-1/4" EFF EMBEDMENT.

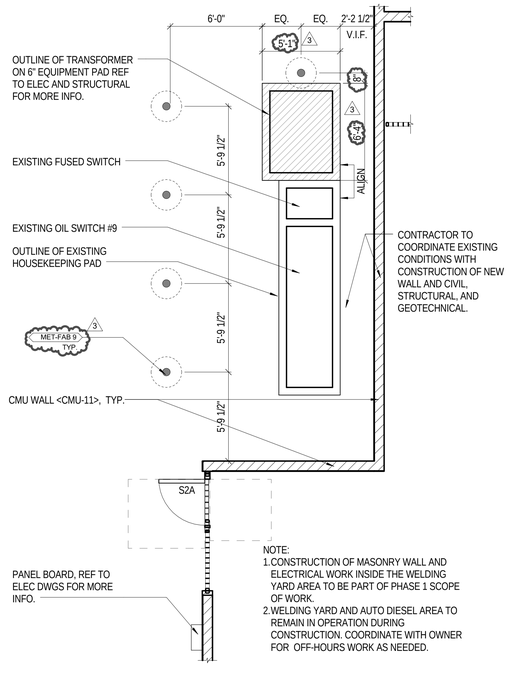
7 ANCHORING DETAIL AT VICES
NTS



6 AUTOMATIC DOOR OPERATOR DETAIL
1 1/2" = 1'-0"

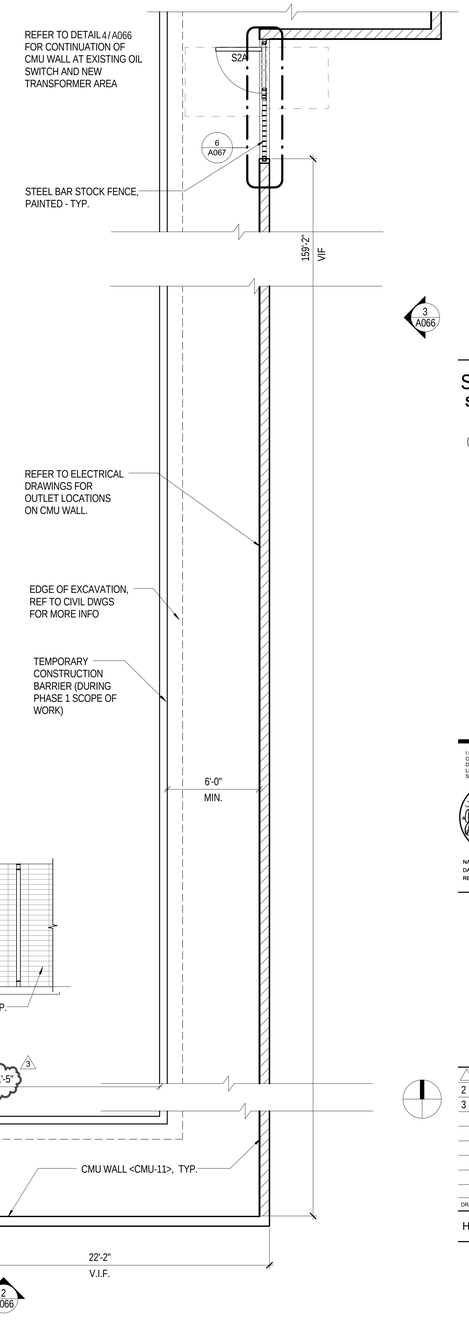


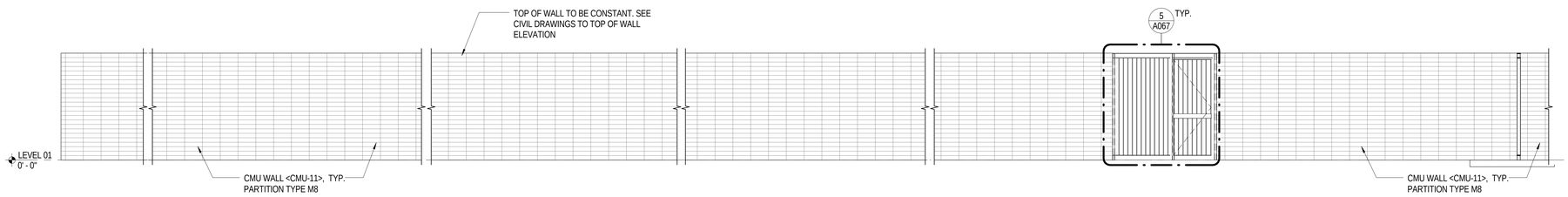
5 ACCESSIBLE DROP OFF
1/4" = 1'-0"



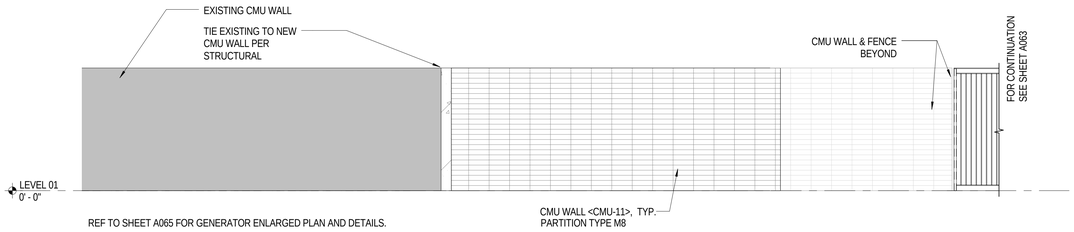
NOTE:
1. CONSTRUCTION OF MASONRY WALL AND ELECTRICAL WORK INSIDE THE WELDING YARD AREA TO BE PART OF PHASE 1 SCOPE OF WORK.
2. WELDING YARD AND AUTO DIESEL AREA TO REMAIN IN OPERATION DURING CONSTRUCTION. COORDINATE WITH OWNER FOR OFF-HOURS WORK AS NEEDED.

4 NEW TRANSFORMER AND EXISTING OIL SWITCH - ENLARGED PLAN
1/4" = 1'-0"

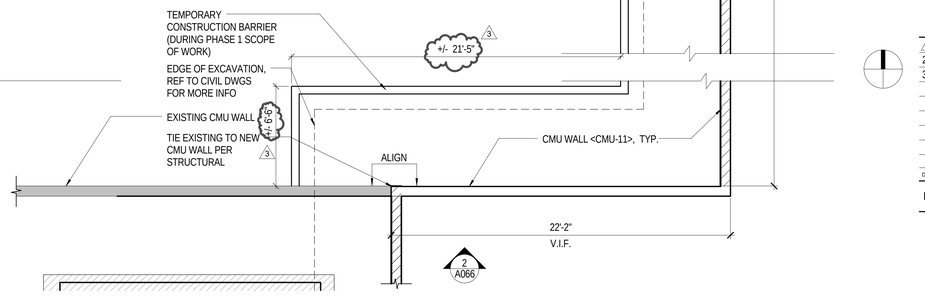




3 SITE WALL - EAST ELEVATION
1/4" = 1'-0"



2 SITE WALL - SOUTH ELEVATION
1/4" = 1'-0"



NOTE:
1. CONSTRUCTION OF MASONRY WALL AND ELECTRICAL WORK INSIDE THE WELDING YARD AREA TO BE PART OF PHASE 1 SCOPE OF WORK.
2. WELDING YARD TO REMAIN IN OPERATION DURING CONSTRUCTION. COORDINATE WITH OWNER FOR THE CONSTRUCTION OF TEMPORARY CONSTRUCTION BARRIER DURING OFF-HOURS.
3. REF TO SHEET A065 FOR GENERATOR ENLARGED PLAN AND DETAILS.

1 SITE WALL - ENLARGED PLAN
1/4" = 1'-0"

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Santa Monica , California 90405
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LICENSED ARCHITECT JAMES G. MATSON No. C13036 RENEWAL DATE SEPTEMBER 30, 2017 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

SITE - ENLARGED PLANS AND DETAILS

DATE: JULY 06, 2017

A066

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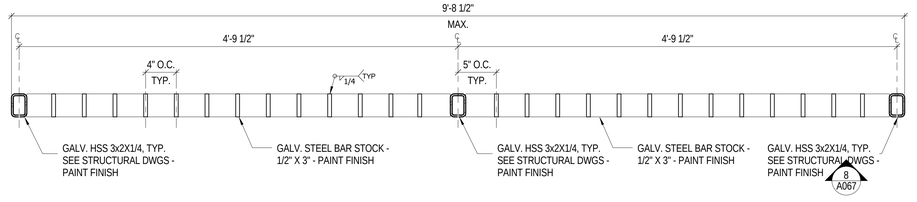
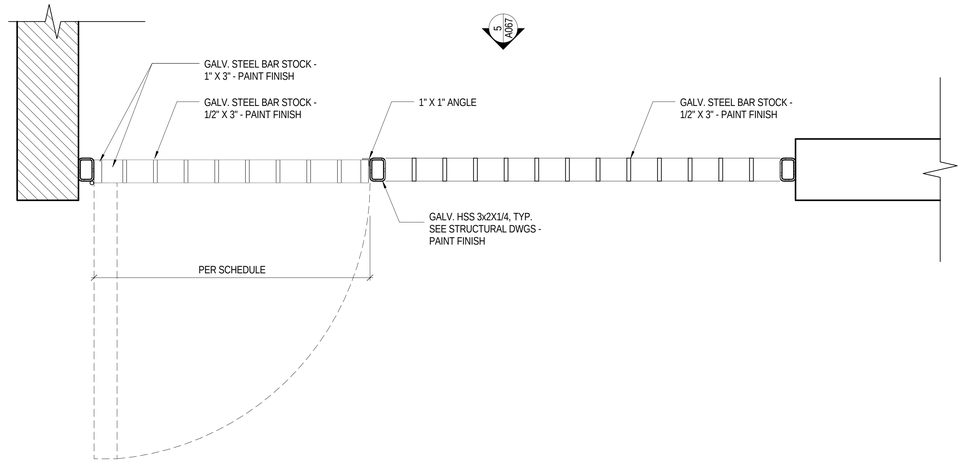
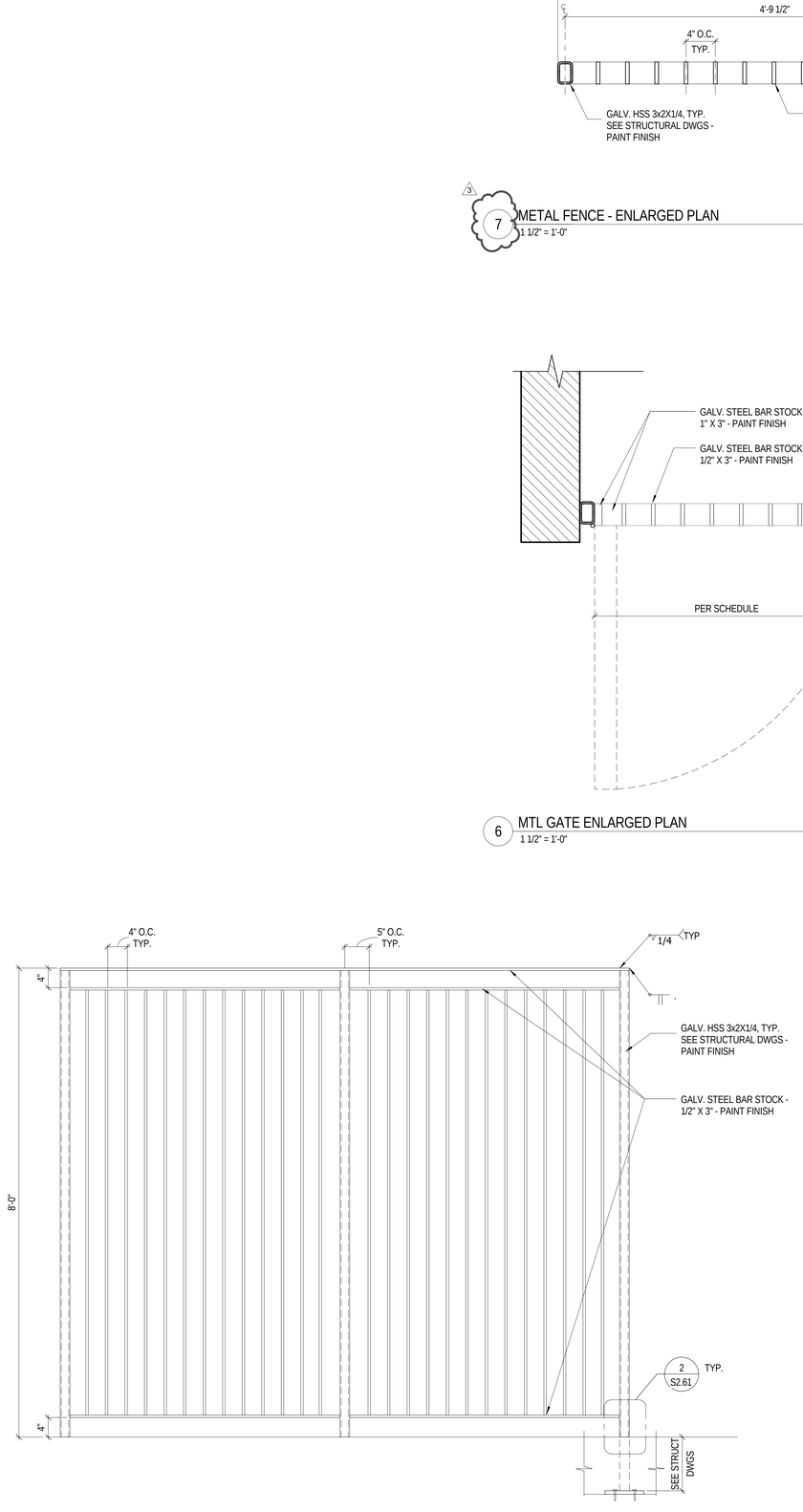


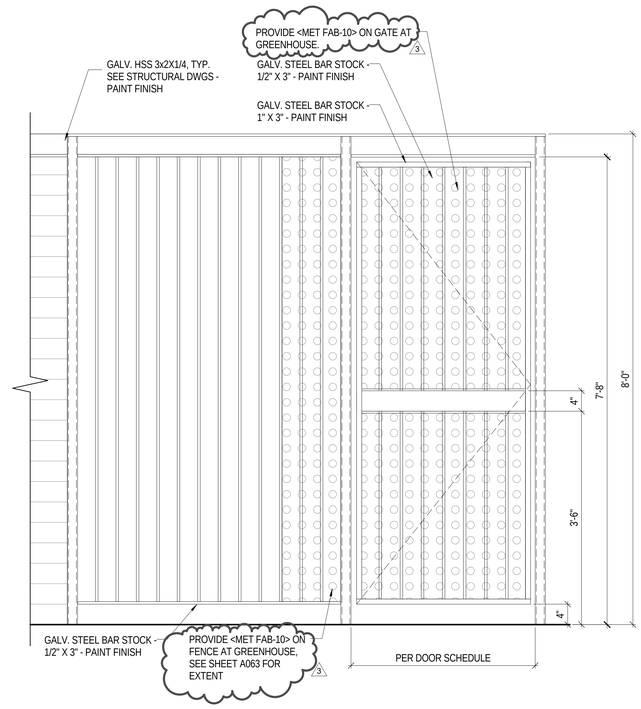
7 METAL FENCE - ENLARGED PLAN
1 1/2" = 1'-0"



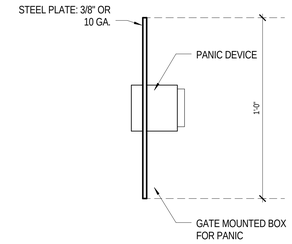
6 MTL GATE ENLARGED PLAN
1 1/2" = 1'-0"



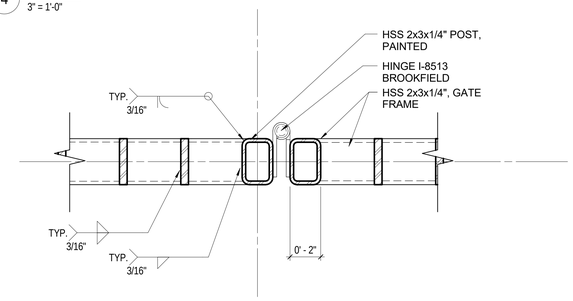
8 ENLARGED FENCE ELEVATION - TYP.
1" = 1'-0"



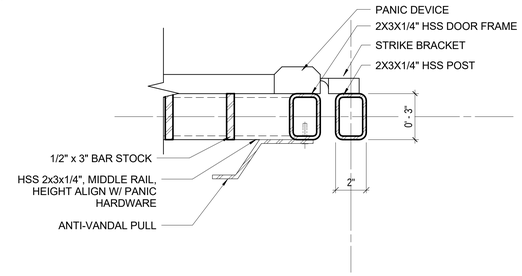
5 ENLARGED FENCE DOOR ELEVATION - TYP.
1" = 1'-0"



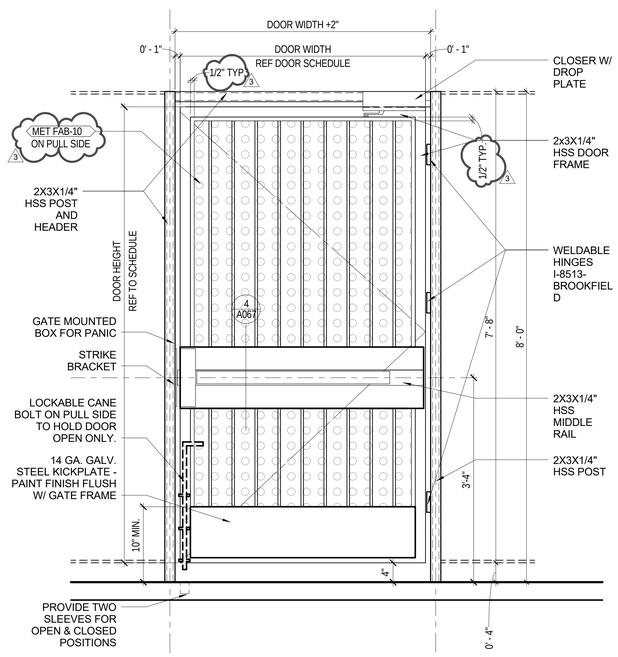
4 FENCE EXIT GATE PANIC DEVICE
3" = 1'-0"



3 FENCE IN SWING GATE POST
3" = 1'-0"



2 FENCE EXIT GATE POST (STRIKE)
3" = 1'-0"



1 EXIT GATE ELEVATION AT STAIR #1 AND STAIR #2 (INSIDE VIEW)
1" = 1'-0"

hga.
1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL &
PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

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RANCHO SANTIAGO
COMMUNITY COLLEGE
DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA
COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON
No. C13036
LICENSED ARCHITECT
SEPTEMBER 30, 2017
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: TE

HGA NO: 3584-001-00

FENCE & GATE DETAILS

DATE: JULY 06, 2017

A067

ADDENDA PACKAGE

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A. NOT ALL DOOR AND FRAME TYPES SHOWN HERE MAY BE USED IN THIS PROJECT.

B. FOR FRAME AND GLASS TYPES REFER TO MATERIAL ID, PLANS, DOOR AND FRAME SCHEDULE, ELEVATIONS AND DETAILS.

C. INSTALL TEMPERED GLASS PER CODE (CBC 2406).

D. REFER TO PLANS FOR INTERIOR PARTITION TYPES AND EXTERIOR WALL TYPES.

E. HOLLOW METAL FRAMES AT MASONRY PARTITIONS SHALL BE GROUTED SOLID.

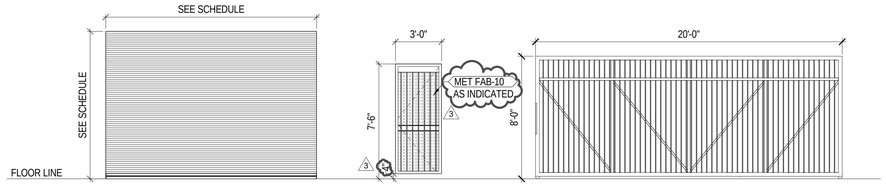
F. HOLLOW METAL FRAMES AT METAL STUD PARTITIONS SHALL BE SPOT GROUTED AT ALL FRAME ANCHORS WITH JOINT COMPOUND.

G. REFER TO DOOR AND FRAME SCHEDULE FOR FRAME WIDTHS AND FOR DOOR INFORMATION.

H. CONTINUE GYPSUM BOARD OF HIGHER FIRE RATED PARTITION CONTINUOUSLY PAST LOWER RATED, INTERSECTING PARTITION(S) TYPICAL.

I. REFER TO SHEET A673 FOR DETAILS ON VERTICAL WALL SYSTEM.

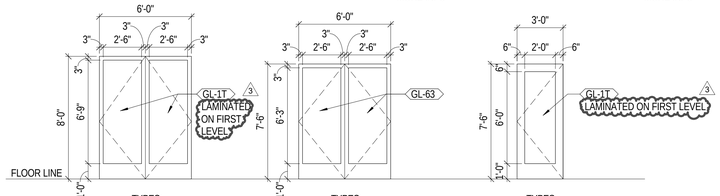
4 DOOR AND FRAME GENERAL NOTES



TYPES: CD-1 FIRE-RATED COILING DOOR

TYPES: GATE REF TO SHT A067 FOR MORE INFO

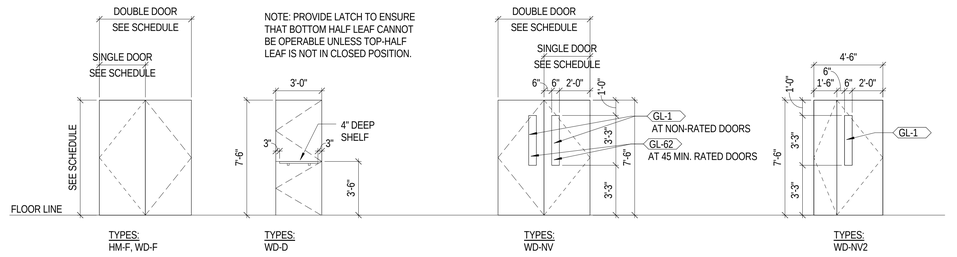
TYPES: SLIDING GATE REF TO SHT A065 FOR MORE INFO



TYPES: AL REF TO CURTAIN WALL TYPES ON SHT A491 FOR MORE INFO.

TYPES: STL-FR REF TO CURTAIN WALL TYPES ON SHT A491 FOR MORE INFO.

TYPES: AL-FG REF TO CURTAIN WALL TYPES ON SHT A491 AND INT. GLAZING TYPES ON SHT A630 FOR MORE INFO.



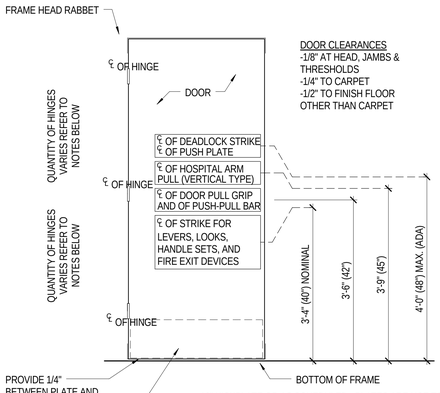
TYPES: HM-F, WD-F

TYPES: WD-D

TYPES: WD-NV

TYPES: WD-NV2

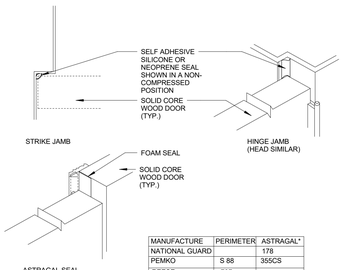
3 TYPICAL DOOR PANEL TYPES



DOOR CLEARANCES
-1/8" AT HEAD, JAMBS & THRESHOLDS
-1/4" TO CARPET
-1/2" TO FINISH FLOOR OTHER THAN CARPET

GENERAL NOTES
A. INFORMATION SHOWN HERE IS FOR REFERENCE ONLY.
B. REFER TO DOOR AND FRAME DETAILS FOR VARIATIONS TO THIS DETAIL.
C. REVISIONS AS PER MANUFACTURER AND LOCAL CODE VARIATIONS ARE TO BE SUBMITTED FOR REVIEW AND FINAL APPROVAL.
D. USE 3 HINGES FOR DOORS UP TO INCLUDING 7'-8".
E. ADD 1 HINGE FOR EACH 2'-6" IN HEIGHT OR FRACTION THEREOF AND FOR DOORS GREATER THAN 3'-6" IN WIDTH.
F. ALL OPERATING HARDWARE SHALL BE MOUNTED BETWEEN 34" AND 44" ABOVE FINISHED FLOOR UNLESS DIRECTED OTHERWISE BY APPLICABLE CODES.
G. EXTEND DOOR OPENING JAMBS AND DOOR-TO DOOR MULLIONS 1/8" BELOW THE FINISH FLOOR ELEVATION WHEN THE FLOOR FINISH IS TO BE INSTALLED AFTER FRAME.

7 DOOR HARDWARE LOCATIONS

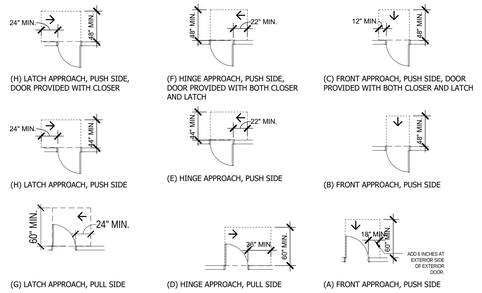


MANUFACTURE	PERIMETER	ASTRAGAL*
NATIONAL GUARD		178
PEMKO	S 88	355CS
REESE	797	
ZERO		1840

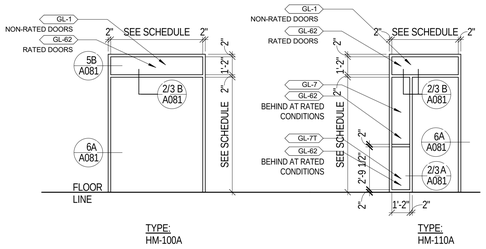
* NO ACOUSTICAL TEST DATA FROM MANUFACTURE

NOTES:
1. INSTALL DOOR IN FRAME WITH 1/8" MAX. TOLERANCE @ HEAD, HINGE & STRIKE JAMB.
2. PERIMETER SEAL SHALL ALWAYS BE MIN. SEMI COMPRESSED WITH DOOR CLOSED.
3. IF TOLERANCE @ PERIMETER IS GREATER THAN 1/8" & DOOR CANNOT BE ADJUSTED, REPLACE WITH 1/2" SEAL INSTEAD OF 1/4" SEAL.

6 DOOR SEAL DETAILS
3" = 1'-0"



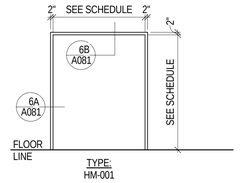
5 DOOR MANEUVERING CLEARANCES
1/8" = 1'-0"



TYPE: HM-100A

TYPE: HM-110A

2 HOLLOW METAL FRAME TYPES-DOOR W/ SIDELIGHT & TRANSOM



TYPE: HM-001

1 HOLLOW METAL FRAME TYPES-DOORS

1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

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155 N LAKE AVE
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1530 W. 17TH ST.
SANTA ANA, CA 92706

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

LICENSED ARCHITECT — JAMES G. MATSON — No. C13036 — REGISTERED PROFESSIONAL ENGINEER — SEPTEMBER 30, 2019 — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: TE

HGA NO: 3584-001-00

TYPICAL DOOR AND FRAME TYPES, NOTES, AND DETAILS

DATE: JULY 06, 2017

A080

ADDENDA PACKAGE

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DOOR NUMBER	ROOM NAME	DOOR WIDTH	DOOR HEIGHT	DOOR TYPE	DOOR GLAZING TYP	DOOR FINISH	FRAME TYPE	FRAME GLAZING TYP	FRAME FINISH	HEAD	JAMB	SILL/ THRESHOLD	RATING (MIN)	HDWE GROUP	ELEC	ALARM	SECURITY TYPE	NOTES
100-1A	CORRIDOR	6' - 0"	7' - 6"	STL-FR	GL-63	NOTE 9	SF3	GL-63	NOTE 9	6 / A443	3 / A443	10D/ A081	60 MIN.	SH-1	X	X	CR	PH, ADO
100A	CORRIDOR	6' - 0"	7' - 6"	STL-FR	GL-63	NOTE 9	SF5	GL-63	NOTE 9	6 / A443	3 / A443	10D/ A081	60 MIN.	SH-1A	X	X	CR	PH, ADO
100B	CORRIDOR	6' - 0"	8' - 0"	AL	GL-1T	NOTE 8	CW3	GL-1T	NOTE 8	2 / A434	1 / A456	10D/ A081	--	SH-1A.1	X	X	CR	PH, ADO
101A	RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-2	--	--	--	--
102A	MEN'S RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-1	--	--	--	--
103-1A	MODEL STORAGE / LOCKERS	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-5C	--	--	--	--
103-2A	WORK ROOM	3' - 0"	7' - 6"	AL-FG	GL-1T	PT-5D	F1	--	PT-5D	5B/ A081	2 / A451	--	--	HW-1B	--	--	--	--
103A	SCIENCE LEARNING CENTER	3' - 0"	7' - 6"	WD-NV	GL-62	WD-1	HM-100A	GL-62	PT-5D	3B/ A081	3A/ A081	--	45 MIN.	SH-7A	--	X	CR	WMR, PH, DPS
103B	SCIENCE LEARNING CENTER	3' - 0"	8' - 0"	AL-FG	GL-1T	NOTE 7	SF1	GL-1T	NOTE 7	1 / A431SIM	4 / A451	10D/ A081	--	SH-6	--	X	CR	--
103C	SCIENCE LEARNING CENTER	11' - 0"	11' - 0"	CD-1	--	--	--	--	--	2 / A667	7 / A664	--	90 MIN.	MFR	X	--	--	--
103D	SCIENCE LEARNING CENTER	15' - 0"	11' - 0"	CD-1	--	--	--	--	--	2 / A667	7 / A664	--	90 MIN.	MFR	X	--	--	--
104A	WOMEN'S RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-1	--	--	--	--
105A	LOBBY	6' - 0"	8' - 0"	AL	GL-1T	NOTE 8	CW1	GL-1T	NOTE 8	1 / A431	1 / A452	10D/ A081	--	SH-1A.1	X	X	CR	PH, ADO
105B	LOBBY	6' - 0"	8' - 0"	AL	GL-1T	NOTE 8	CW1	GL-1T	NOTE 8	1 / A431	1 / A452	10D/ A081	--	SH-4	--	X	CR	PH, DPS
106A	CUSTODIAL	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-5	--	--	--	--
107A	MACHINE ROOM	4' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	45 MIN.	SH-5A	--	X	--	--
109A	BDF	4' - 0"	7' - 6"	HM-F	--	PT-4D	HM-001	--	PT-4D	6B/ A081	6A/ A081	--	45 MIN.	SH-2A.1	--	X	CR	--
110A	VESTIBULE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B.1	--	X	CR	
110C	CONFERENCE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-1A	--	--	--	--
111A	LARGE CLASSROOM	3' - 0"	7' - 6"	WD-NV	GL-62	WD-1	HM-110A	GL-62T, GL-7(T)	PT-5D	3B/ A081	3A/ A081	--	45 MIN.	SH-9	--	X	CR	PH
111B	LARGE CLASSROOM	3' - 0"	7' - 6"	WD-NV	GL-62	WD-1	HM-110A	GL-62T, GL-7(T)	PT-5D	3B/ A081	3A/ A081	10B/ A081	45 MIN.	SH-9A	--	X	I/L111A	PH, WMR, ADB
113-1A	LARGE CLASSROOM (DIVISIBLE)	3' - 0"	7' - 6"	WD-NV	GL-62	WD-1	HM-110A	GL-62T, GL-7(T)	PT-5D	3B/ A081	3A/ A081	--	45 MIN.	SH-9A	--	X	CR	PH
113-2A	LARGE CLASSROOM (DIVISIBLE)	3' - 0"	7' - 6"	WD-NV	GL-62	WD-1	HM-110A	GL-62T, GL-7(T)	PT-5D	3B/ A081	3A/ A081	--	45 MIN.	SH-9	--	X	CR	PH
114A	ELECTRICAL CLOSET	6' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-14	--	X	--	--
114B	ELECTRICAL CLOSET	6' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-14	--	X	--	--
115A	MULTI DISC COMPUTER LAB	3' - 0"	7' - 6"	WD-NV	GL-62	WD-1	HM-110A	GL-62T, GL-7(T)	PT-5D	3B/ A081	3A/ A081	--	--	SH-2B	--	X	CR	--
116-1A	OPEN OFFICE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2B.1	--	X	CR	--
116-1B	OFFICE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2B.1	--	X	CR	--
116A	RECEPTION	3' - 0"	7' - 6"	AL-FG	GL-1T	PT-5D	F5	--	PT-5D	2B/ A081	2A/ A081	--	--	SH-15	--	X	CR	I/L
116B	RECEPTION	3' - 0"	2' - 6"	WD-F	--	PLAM-2	--	--	PT-5D	--	6A/ A081	--	--	HW-3B	--	--	--	DOUBLE ACTING
118A	GEOLOGY / EARTH SCIENCE LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.3	--	X	CR	ADB
118B	GEOLOGY / EARTH SCIENCE LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	10B/ A081	--	SH-7E	--	X	I/L 118A	ADB, UNEQUAL: 3'-0", 1'-6"
120A	GEOLOGY / PHYSICAL SCIENCE PREP & STORAGE	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	CR	UNEQUAL: 3'-0", 1'-6"
120B	GEOLOGY / PHYSICAL SCIENCE LAB & LECTURE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
120C	GEOLOGY / EARTH SCIENCE LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
122A	GEOLOGY / PHYSICAL SCIENCE LAB & LECTURE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B.3	--	X	CR	--
122B	GEOLOGY / PHYSICAL SCIENCE LAB & LECTURE	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7E	--	X	I/L 122A	ADB, UNEQUAL: 3'-0", 1'-6"
124A	STORAGE	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-12	--	X	CR	--
126A	EMERGENCY ELECTRICAL	3' - 0"	7' - 6"	HM-F	--	NOTE 6	HM-001	--	NOTE 6	6B/ A081	6A/ A081	10B/ A081	--	SH-8	--	X	--	PH
128A	MECHANICAL ROOM	6' - 0"	7' - 6"	HM-F	--	NOTE 6	HM-001	--	NOTE 6	6B/ A081	6A/ A081	10B/ A081	--	SH-5	--	X	--	
128B	MECHANICAL ROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2A	--	X	CR	--
130A	MAIN ELECTRICAL	4' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	45 MIN.	SH-13	--	X	--	PH
132A	ENGINEERING PREP & STORAGE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-12	--	X	CR	--
132B	ENGINEERING PREP & STORAGE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
134A	ENGINEERING LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.3	--	X	CR	ADB
134B	ENGINEERING LAB	6' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-11B	--	--	I/L 134A	EPH, ADB
200-1A	CORRIDOR	6' - 0"	7' - 6"	STL-FR	GL-63	NOTE 9	SF3	GL-63	NOTE 9	6 / A443	3 / A443	--	60 MIN.	SH-1B	X	X	CR	PH
200-1B	CORRIDOR	3' - 0"	7' - 6"	WD-NV	GL-62	WD-1	HM-001	--	PT-5D	2B/ A081	2A/ A081	--	45 MIN.	HW-7	--	--	--	PH, MHO
200-1C	STAIR #2	3' - 0"	7' - 6"	GATE	--	PT-5E	--	--	--	NOTE 4	NOTE 4	--	--	HW-20	--	--	--	PH
200A	CORRIDOR	6' - 0"	7' - 6"	STL-FR	GL-63	NOTE 9	SF5	GL-63	NOTE 9	6 / A443	3 / A443	--	60 MIN.	SH-1B	X	X	CR	PH
200B	STAIR #1	3' - 0"	7' - 6"	GATE	--	PT-5E	--	--	--	NOTE 4	NOTE 4	--	--	HW-20	--	--	--	PH
201-1A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201-2A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201-3A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201-4A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201-5A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201-6A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201-7A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201A	CORRIDOR	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
201B	CORRIDOR	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	10B/ A081	--	SH-2.1	--	X	CR	ADB
202A	MEN'S RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-1	--	--	--	--
203A	RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-2	--	--	--	--
204A	WOMEN'S RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-1	--	--	--	--
206A	CUSTODIAL	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-5	--	--	--	--
208A	CLASSROOM	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B.1	--	X	CR	ADB
209A	STAFF ROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3C	--	--	--	--
210A	ELEC. CLOSET	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-5	--	--	--	--
211A	IDF	4' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2A	--	X	CR	--
212A	MOLECULAR BIOLOGY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	10B/ A081	--	SH-7E	--	X	CR	ADB, UNEQUAL: 3'-0", 1'-6"
212B	MOLECULAR BIOLOGY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B	--	X	I/L212A	ADB
213A	PHYSIOLOGY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	10B/ A081	--	SH-7E	--	X	CR	ADB, UNEQUAL: 3'-0", 1'-6"
213B	PHYSIOLOGY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B	--	X	I/L213A	ADB
213C	PHYSIOLOGY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
214A	MOLECULAR BIOLOGY PREP & STORAGE	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	CR	UNEQUAL: 3'-0", 1'-6"
214B	MICROBIOLOGY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
214C	MOLECULAR BIOLOGY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--

DOOR NUMBER	ROOM NAME	DOOR WIDTH	DOOR HEIGHT	DOOR TYPE	DOOR GLAZING TYP	DOOR FINISH	FRAME TYPE	FRAME GLAZING TYP	FRAME FINISH	HEAD	JAMB	SILL/ THRESHOLD	RATING (MIN)	HDWE GROUP	ELEC	ALARM	SECURITY TYPE	NOTES
215A	ANATOMY & PHYSIOLOGY PREP & STORAGE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T)	PT-5D	2B/ A081	2A/ A081	--	--	SH-2D	--	X	CR	--
215B	ANATOMY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
216A	MICROBIOLOGY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7	--	X	I/L216B	PH, UNEQUAL: 3'-0", 1'-6"
216B	MICROBIOLOGY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B	--	X	CR	--
217-1A	CADAVER ROOM	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	10B/ A081	--	HW-12A	--	--	--	ADB
217A	ANATOMY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B	--	X	CR	--
217B	ANATOMY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-7(T), GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7	--	X	I/L 217A	UNEQUAL: 3'-0", 1'-6"
218A	GENERAL BIOLOGY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2C	--	X	CR	--
218B	GENERAL BIOLOGY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	I/L 218A	DPS, UNEQUAL: 3'-0", 1'-6"
220A	ORGANISMAL BIOLOGY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
220B	GENERAL BIOLOGY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
220C	GENERAL & ORGANISMAL PREP & STORAGE	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	CR	UNEQUAL: 3'-0", 1'-6"
222A	WASTE	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2B.1	--	X	CR	ADB
224A	ELEC. CLOSET	6' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-14	--	X	--	--
224B	ELEC. CLOSET	6' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-14	--	X	--	--
226A	ORGANISMAL BIOLOGY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B	--	X	CR	--
226B	ORGANISMAL BIOLOGY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7	--	X	I/L 226A	UNEQUAL PAIR: 3'-0", 1'-6"
300-1A	CORRIDOR	6' - 0"	7' - 6"	STL-FR	GL-63	NOTE 9	SF4	GL-63	NOTE 9	6 / A443	3 / A443	--	60 MIN.	SH-1B	--	X	CR	PH
300A	CORRIDOR	6' - 0"	7' - 6"	STL-FR	GL-63	NOTE 9	SF5	GL-63	NOTE 9	6 / A443	3 / A443	--	60 MIN.	SH-1B	--	X	CR	PH
301-1A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
301-2A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
301-3A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
301-4A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
301-5A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
301-6A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
301-7A	OFFICE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2B.1	--	X	CR	ADB
301A	CORRIDOR	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	---	SH-2B	--	X	CR	ADB
301B	CORRIDOR	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	10B/ A081	--	SH-2.1	--	X	CR	ADB
302A	MEN'S RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-1	--	--	--	--
303A	RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-2	--	--	--	--
304A	WOMEN'S RESTROOM	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	9 / A081	--	HW-1	--	--	--	--
306A	CUSTODIAL	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-5	--	--	--	--
307A	IDF	4' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2A	--	X	CR	--
308A	CLASSROOM	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B.1	--	X	CR	ADB
309A	CHEMISTRY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B	--	X	CR	ADB
309B	CHEMISTRY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7	--	X	I/L 309A	UNEQUAL: 3'-0", 1'-6"; ADB
310A	ELEC. CLOSET	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-5A	--	X	--	--
311A	WASTE	3' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2B.2	--	X	CR	--
312A	PHYSICS LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	10B/ A081	--	SH-2	--	X	CR	ADB
312B	PHYSICS LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	10B/ A081	--	SH-7C.1	--	X	I/L 312A	ADB, UNEQUAL: 3'-0", 1'-6"
313A	CHEMISTRY PREP & STORAGE	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2D	--	X	CR	--
313B	CHEMISTRY PREP & STORAGE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
313C	CHEMISTRY PREP & STORAGE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
314A	PHYSICS PREP & STORAGE	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	CR	UNEQUAL: 3'-0", 1'-6"
314B	PHYSICS LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3D	--	--	--	--
315A	CHEMISTRY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B	--	X	CR	--
315B	CHEMISTRY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081		--	SH-7	--	X	I/L 315A	UNEQUAL: 3'-0", 1'-6"
316A	CHEMISTRY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B	--	X	CR	--
316B	CHEMISTRY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7	--	X	I/L 316A	UNEQUAL: 3'-0", 1'-6"
318A	CHEMISTRY PREP & STORAGE	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	CR	UNEQUAL: 3'-0", 1'-6"
318B	CHEMISTRY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
320-1A	INSTRUMENT ROOM	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-2C.1	--	X	CR	--
320A	ORGANIC CHEMISTRY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	CR	UNEQUAL: 3'-0", 1'-6"
320B	ORGANIC CHEMISTRY LAB	3' - 0"	7' - 6"	WD-D	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-5E	--	--	--	DUTCH DOOR
322-1A	CHEMICAL STORAGE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	45 MIN.	HW-5B	--	--	--	--
322-2A	CHEMICAL STORAGE	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	45 MIN.	HW-5B	--	--	--	--
322A	CHEMISTRY LAB	3' - 0"	7' - 6"	WD-F	--	WD-1	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	HW-3A	--	--	--	--
322B	CENTRALIZED PREP & STORAGE	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7B	--	X	CR	UNEQUAL: 3'-0", 1'-6"
324A	ELEC. CLOSET	6' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-14	--	X	--	--
324B	ELEC. CLOSET	6' - 0"	7' - 6"	HM-F	--	PT-2D	HM-001	--	PT-5D	6B/ A081	6A/ A081	--	--	SH-14	--	X	--	--
326A	CHEMISTRY LAB	3' - 0"	7' - 6"	WD-NV	GL-1	WD-1	HM-110A	GL-7(T), GL-1	PT-5D	2B/ A081	2A/ A081	--	--	SH-2B.1	--	X	CR	--
326B	CHEMISTRY LAB	4' - 6"	7' - 6"	WD-NV2	GL-1	WD-1	HM-100A	GL-1	PT-5D	2B/ A081	6A/ A081	--	--	SH-7	--	X	I/L 326A	UNEQUAL: 3'-0", 1'-6"
400A	STAIR #1	4' - 0"	7' - 6"	GATE	--	NOTE 6	--	--	--	NOTE 4	NOTE 4	--	--	SH-18	--	X	--	--
S1A	GENERATOR	4' - 0"	6' - 10"	HM-F	--	PT-2D	HM-001	--	PT-5D	8A/ A081	8B/ A081	--	--	SH-8	X	X	CR	--
S1B	GENERATOR	20' - 0"	8' - 0"	SLIDING GATE	--	PT-5E	--	--	--	NOTE 5	NOTE 5	--	--	HW-13	--	--	--	--
S2A		3' - 0"	7' - 6"	GATE	--	PT-5E	--	--	--	NOTE 4	NOTE 4	--	--	HW-18	--	--	--	--
SC001A	GREENHOUSE	6' - 0"	7' - 10"	AL	GL-21	PT-5D	MFR	GL-24T	PT-5D	5 / A081	5 / A081	--	--	SH-19	X	X	CR	PH
SC001B	GREENHOUSE	3' - 0"	7' - 6"	GATE	--	PT-5E	--	--	--	NOTE 4	NOTE 4	--	--	SH-20	--	X	CR	PH
SC001C	GREENHOUSE	3' - 0"	7' - 6"	GATE	--	PT-5E	--	--	--	NOTE 4	NOTE 4	--	--	SH-20	--	X	CR	PH

NOTES:

1. REFER TO SHEET A081 FOR ALL HEAD, JAMB, SILL, AND GLAZING DETAILS, UNLESS NOTED OTHERWISE.
2. REFERENCE CW/SF FRAME TYPES ON SHEET A491.
3. REFERENCE F FRAME TYPES ON SHEET A630.
4. REFERENCE SHEET A067 FOR GATE DETAILS.
5. REFERENCE SHEET A065 FOR SLIDING GATE DETAILS.
6. COLOR TO MATCH <MP-2A> COLOR
7. COLOR TO MATCH <AFS-2> COLOR
8. COLOR TO MATCH <CW-1> COLOR
9. COLOR TO MATCH <CW-3> COLOR

ABBREVIATIONS

ADB	AUTOMATIC DOOR BOTTOM
ADO	AUTOMATIC DOOR OPERATOR
AL	CLEAR ANODIZED ALUMINUM
CR	CARD READER
DPS	DOOR POSITION SWITCH
EC	ELECTRONIC HARDWARE WITHOUT A CARD READER
EML	OMNI CARD READER STAND ALONE
EH	ELECTRIC PANIC HARDWARE
I/L	INTERLOCK, CR AT INDICATED DOOR UNLOCKS
MFR	MANUFACTURER
MHO	MAGNETIC HOLD OPEN
MP	METAL PANEL
PH	PANIC HARDWARE
FS	FIRE SHUTTER
WMR	WALL-MOUNTED READER

HGA
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MECHANICAL & PLUMBING ENGINEER
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SCIENCE CENTER
SANTA ANA COLLEGE
RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2019 RENEWAL DATE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK REVIEW BY: TE

HGA NO: 3584-001-00

DOOR AND FRAME SCHEDULE

DATE: JULY 06, 2017

A082

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ROOM FINISH SCHEDULE

d	ROOM NUMBER	AREA	ROOM NAME	FLOOR FINISH	FLOOR BASE	WALLS NORTH	WALLS EAST	WALLS SOUTH	WALLS WEST	CEILING MATL	CEILING FINISH	NOTES
	001	145 SF	ELEVATORS	--	--	--	--	--	--	--	--	REFER TO SHEET A521 FOR FINISH INFORMATION.
	400	351 SF	STAIR #1	CS-2	--	--	--	--	--	--	--	
	401	485 SF	STAIR #2	CS-2	--	--	--	--	--	--	--	
	402	232 SF	STAIR #3	TER-4	--	--	--	--	--	--	--	
	S1	836 SF	GENERATOR	CS-2	--	--	--	--	--	--	--	
	SC001	762 SF	GREENHOUSE	CS-2	--	--	--	--	--	--	--	
	SC003	1,256 SF	GREENHOUSE	CS-2	--	--	--	--	--	--	--	
	SC100	1,302 SF	CORRIDOR	RSF-1 / RSF-2	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	ACT-2	--	
	SC100-1	1,983 SF	CORRIDOR	RSF-1 / RSF-2	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	--	ACT-2 / GYP	-- / PT-4C	
	SC101	62 SF	RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A	PT-1A / CTW	GYP	PT-1B	
	SC102	238 SF	MEN'S RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC103	1,200 SF	SCIENCE LEARNING CENTER	CPT-1	RB-2	PT-1A	PT-1A / PT-2A	PT-2A	PT-1A	ACT-2 / GYP	-- / PT-1C	
	SC103-1	142 SF	MODEL STORAGE / LOCKERS	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC103-2	124 SF	WORK ROOM	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC104	244 SF	WOMEN'S RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC105	695 SF	LOBBY	TER-3 / TER-4 / CPT-50	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-3 / GYP	-- / PT-1A	
	SC106	47 SF	CUSTODIAL	CS-2	RB-1	PT-1A / FRP-1	PT-1A	PT-1A	PT-1A / FRP-1	XPD	--	FRP-1 AT SINK, 4'-0" HIGH, EXTEND 1'-0" BEYOND SINK EDGE
	SC107	105 SF	MACHINE ROOM	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	XPD	--	
	SC109	218 SF	BDF	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	XPD	--	PROVIDE FIRE TREATED PLYWOOD BACKBOARD ON WALLS PER T1.2 3
	SC110	71 SF	VESTIBULE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC110-1	249 SF	OPEN OFFICE	RSF-1	RB-1	PT-1A	PT-1A	--	PT-1A	ACT-2	--	
	SC110-2	125 SF	WORK ROOM	RSF-1	RB-1	--	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC110-3	333 SF	CONFERENCE	CPT-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC110-4	99 SF	DIVISION OFFICE ARCHIVE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC111	1,520 SF	LARGE CLASSROOM	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC113-1	725 SF	LARGE CLASSROOM (DIVISIBLE)	RSF-1 / RSF-2	RB-1	VWS-1	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC113-2	735 SF	LARGE CLASSROOM (DIVISIBLE)	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	VWS-1	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC114	35 SF	ELECTRICAL CLOSET	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	XPD	--	
	SC115	920 SF	MULTI DISC COMPUTER LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	--/PT-3C	
	SC116	341 SF	RECEPTION	CPT-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC116-1	181 SF	OFFICE	CPT-1	RB-1	PT-2A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC118	1,231 SF	GEOLOGY / EARTH SCIENCE LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC120	627 SF	GEOLOGY / PHYSICAL SCIENCE PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC122	1,550 SF	GEOLOGY / PHYSICAL SCIENCE LAB & LECTURE	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC124	129 SF	STORAGE	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	XPD	--	
	SC126	169 SF	EMERGENCY ELECTRICAL	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	XPD	--	
	SC128	1,707 SF	MECHANICAL ROOM	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	XPD	--	
	SC130	208 SF	MAIN ELECTRICAL	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	XPD	--	
	SC132	305 SF	ENGINEERING PREP & STORAGE	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC134	1,546 SF	ENGINEERING LAB	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-3 / GYP / XPD	-- / PT-3C / --	
	SC136	25 SF	VENDING	RSF-1	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	--	ACT-2	--	
	SC138	14 SF	DRINKING FOUNTAINS	RSF-1	RB-1	--	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	ACT-2	--	
	SC200	1,401 SF	CORRIDOR	RSF-1 / RSF-2	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	ACT-2 / GYP	-- / PT-4C	
	SC200-1	2,459 SF	CORRIDOR	RSF-1 / RSF-2	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	--	ACT-2 / GYP	-- / PT-4C	
	SC201	186 SF	WORK STATIONS	CPT-1	RB-2	--	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC201-1	129 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC201-2	128 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-2A	PT-1A	PT-1A	ACT-2	--	
	SC201-3	127 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-2A	PT-1A	PT-1A	ACT-2	--	
	SC201-4	128 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC201-5	126 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-2A	PT-1A	PT-1A	ACT-2	--	
	SC201-6	126 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC201-7	128 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC201-8A	56 SF	CORRIDOR	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC201-8B	281 SF	CORRIDOR	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC201-8C	32 SF	CORRIDOR	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	GYP	PT-1C	
	SC202	238 SF	MEN'S RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC203	56 SF	RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC204	244 SF	WOMEN'S RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC205	320 SF	COLLABO	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A / PT-2A	--	AWP-X PT-1A / PT-2A	ACT/GYP	-- / PT-1B	SPECIALTY ACOUSTIC WALL PANEL DESIGN. REFER TO ELEVATION FOR DETAIL.
	SC206	50 SF	CUSTODIAL	CS-2	RB-1	PT-1A / FRP-1	PT-1A	PT-1A	3 PT-1A / FRP-1	ACT	--	FRP-1 AT SINK, 4'-0" HIGH, EXTEND 1'-0" BEYOND SINK EDGE
	SC207	591 SF	CORRIDOR	CPT-1 / CPT-50	RB-1	PT-1A	CNPL-2	PT-1A / PT-2	PT-1A / PT-3	ACT-2 / GYP	-- / PT-1A	
	SC208	908 SF	CLASSROOM	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC209	104 SF	STAFF ROOM	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC210	65 SF	ELEC. CLOSET	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	
	SC211	200 SF	IDF	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	PROVIDE FIRE TREATED PLYWOOD BACKBOARD ON WALLS PER T1.2 3
	SC212	1,537 SF	MOLECULAR BIOLOGY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC213	1,537 SF	PHYSIOLOGY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC214	629 SF	MOLECULAR BIOLOGY PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC215	342 SF	ANATOMY & PHYSIOLOGY PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC216	1,545 SF	MICROBIOLOGY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC217	1,593 SF	ANATOMY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC217-1	332 SF	CADAVER ROOM	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC218	1,574 SF	GENERAL BIOLOGY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC220	686 SF	GENERAL & ORGANISMAL PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC222	126 SF	WASTE	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	
	SC224	26 SF	ELEC. CLOSET	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	
	SC226	1,510 SF	ORGANISMAL BIOLOGY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT/GYP	--/PT-3C	
	SC228	25 SF	VENDING	RSF-1	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	--	ACT-2	--	
	SC230	14 SF	DRINKING FOUNTAINS	RSF-1 / RSF-2	RB-1	--	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	ACT-2	--	
	SC300	1,334 SF	CORRIDOR	RSF-1 / RSF-2	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	ACT-2	--	
	SC300-1	3,063 SF	CORRIDOR	RSF-1 / RSF-2	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	ACT-2	--	
	SC301	185 SF	WORK STATIONS	CPT-1	RB-2	--	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC301-1	129 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC301-2	128 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-2A	PT-1A	PT-1A	ACT-2	--	
	SC301-3	130 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-2A	PT-1A	PT-1A	ACT-2	--	
	SC301-4	131 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC301-5	129 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-2A	PT-1A	PT-1A	ACT-2	--	
	SC301-6	129 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC301-7	131 SF	OFFICE	CPT-1	RB-2	PT-1A	PT-1A	PT-1A	PT-2A	ACT-2	--	
	SC301-8A	56 SF	CORRIDOR	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC301-8B	266 SF	CORRIDOR	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC301-8C	31 SF	CORRIDOR	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC302	238 SF	MEN'S RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC303	55 SF	RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC304	244 SF	WOMEN'S RESTROOM	CTF-1	CTB-1	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	PT-1A / CTW	GYP	PT-1B	
	SC305	317 SF	COLLABO	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A / PT-2A	--	AWP-X PT-1A / PT-2A	ACT-2 / GYP	-- / PT-1A	SPECIALTY ACOUSTIC WALL PANEL DESIGN. REFER TO ELEVATION FOR DETAIL.
	SC306	50 SF	CUSTODIAL	CS-2	RB-1	PT-1A / FRP-1	PT-1A	PT-1A	3 PT-1A / FRP-1	--	--	FRP-1 AT SINK, 4'-0" HIGH, EXTEND 1'-0" BEYOND SINK EDGE
	SC307	334 SF	IDF	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	PROVIDE FIRE TREATED PLYWOOD BACKBOARD ON WALLS PER T1.2 3
	SC308	908 SF	CLASSROOM	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC309	1,538 SF	CHEMISTRY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC310	65 SF	ELEC. CLOSET	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	
	SC311	53 SF	WASTE	CS-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	
	SC312	1,216 SF	PHYSICS LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC313	659 SF	CHEMISTRY PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC314	634 SF	PHYSICS PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC315	1,554 SF	CHEMISTRY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC316	1,527 SF	CHEMISTRY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC318	310 SF	CHEMISTRY PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC320	1,246 SF	ORGANIC CHEMISTRY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC320-1	188 SF	INSTRUMENT ROOM	RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC322	640 SF	CENTRALIZED PREP & STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC322-1	124 SF	CHEMICAL STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC322-2	235 SF	CHEMICAL STORAGE	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2	--	
	SC324	26 SF	ELEC. CLOSET	RSF-1	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	--	--	
	SC326	1,509 SF	CHEMISTRY LAB	RSF-1 / RSF-2	RB-1	PT-1A	PT-1A	PT-1A	PT-1A	ACT-2 / GYP	-- / PT-3C	
	SC328	25 SF	VENDING	RSF-1	RB-1	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	--	ACT-2	--	
	SC330	14 SF	DRINKING FOUNTAINS	RSF-1 / RSF-2	RB-1	--	PT-1A / PT-2A	PT-1A / PT-2A	PT-1A / PT-2A	ACT-2	--	

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LICENSED ARCHITECT JAMES G. MATSON No. C13036 RENEWAL DATE SEPTEMBER 30, 2019 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: AD | REVIEW BY: TE

HGA NO: 3584-001-00

FINISH SCHEDULE

DATE: JULY 06, 2017

A090

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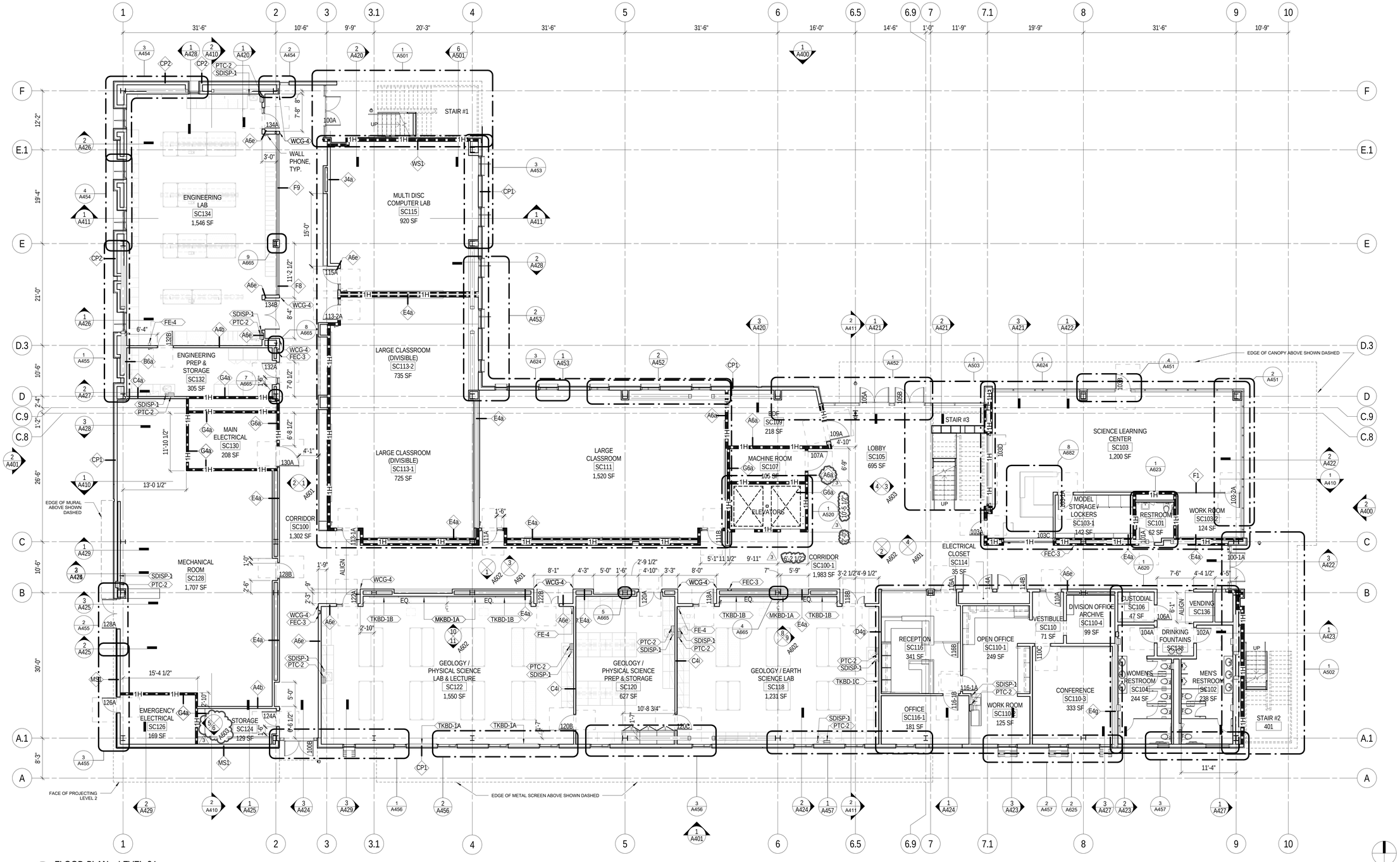
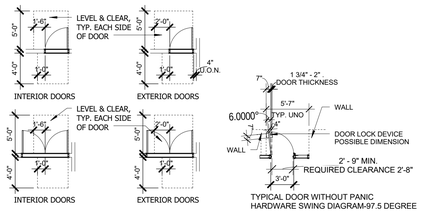


1 FLOOR PLAN - LEVEL 01

1/8" = 1'-0"

TYPICAL CLEARANCE AT DOORS



FLOOR PLAN LEGEND

WALL RATINGS

1H — 1 HR RATED CONSTRUCTION RATING

NOTES AND SYMBOLS

- FLOOR DRAIN PER PLUMBING DRAWINGS
- MB — EXTERIOR WALL TYPE, SEE SHEET A450 FOR DETAILS
- A4 — INTERIOR WALL TYPE, SEE SHEET A660 FOR DETAILS
- 101A — DOOR NUMBER, SEE A082 FOR DOOR SCHEDULE
- AUTOMATIC DOOR OPENER

GENERAL NOTES - CONSTRUCTION PLAN

A. ALL INTERIOR PARTITIONS SHALL BE "A4 ." UNLESS NOTED OTHERWISE.
B. ALL DIMENSIONS ARE CLEAR FROM THE FACE OF FINISHED WALL/PARTITION TO FACE OF FINISHED WALL/PARTITION. SEE PARTITION TYPES FOR ACTUAL THICKNESS OF PARTITIONS. MASONRY WALLS ARE DIMENSIONED TO NOMINAL FACE.
C. ENSURE FINISH SURFACES ARE FLUSH AND SEAMLESS WHERE PARTITIONS AND/OR FURRING ARE COPLANAR.
D. ALL PIPING, CONDUITS AND RELATED MECHANICAL AND ELECTRICAL ITEMS SHALL BE CONCEALED WITHIN PARTITION/WALL ASSEMBLY IN FINISHED AREAS UNLESS NOTED OTHERWISE.
E. PROVIDE BACKING/BLOCKING TO SUPPORT ALL WALL-MOUNTED ITEMS. REFER TO DETAIL 1G/S0.50.
F. ALL MECHANICAL EQUIPMENT PADS TO BE 4" HIGH MINIMUM, UNLESS NOTED OTHERWISE. SIZE OF PADS TO BE VERIFIED BY CONTRACTOR
G. REFER TO SHEET A081 FOR DETAIL OF TYPICAL DOOR JAMB AT ABUTTING WALLS OR PARTITIONS.
H. ALL OFFICES TO HAVE A DOUBLE COAT HOOK <CH-2> MOUNTED ON THE DOOR (ROOM SIDE) UNLESS NOTED OTHERWISE.
I. CONTRACTOR TO PROTECT EXPOSED CONCRETE WORK DURING CONSTRUCTION.
J. ALL EXPOSED STRUCTURAL STEEL MEMBERS TO RECEIVE COATING AND FINISHING OF ARCHITECTURALLY EXPOSED METAL FABRICATION STEEL (AES) MATERIALS WITH HIGH PERFORMANCE COATINGS (HPC) PER SPECS SECTION 099600.
K. ALL MAKER BOARDS AND TACK BOARDS ARE TO BE MOUNTED AS TO HAVE THE BOTTOM AT 36" ABOVE FINSIH FLOOR UNLESS NOTED OTHERWISE.
L. BUTT JOINT, TYP. AT WHERE TWO (2) MARKER BOARD (NO FRAME REQUIRED), PROVIDE WALL RAIL <WR-1> ON ALL SIDES (EXCEPT THE FRONT) IN MULTI DISCIPLINARY COMPUTER LAB SC115, LARGE CLASSROOM (DIVISIBLE) SC113-1 AND SC 113-2, LARGE CLASSROOM SC111, AND CLASSROOMS SC208 AND SC308. REFER A600 FOR MOUNTING DETAILS.
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N. COORDINATE PAPER TOWEL AND SOAP DISPENSERS LOCATIONS WITH LAB PIPING, CASEWORK, AND EQUIPMENT.
O. PROVIDE PHONE AND DATA CONNECTION FOR THE PHONE IN EVERY LAB, LAB SUPPORT ROOM, AND CLASSROOM. LOCATION PER FLOOR PLAN.
P. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SEISMIC ANCHORAGE FOR ALL EQUIPMENT. METHOD OF ANCHORAGE SHALL BE PROVIDED IN A CONCEALED MANNER, AND SHALL RESTRAIN THE EQUIPMENT FROM LATERAL FORCES IN BOTH DIRECTIONS. VERIFY WITH MANUFACTURER REQUIREMENTS.

KEYNOTES - FLOOR PLAN

#	DESCRIPTION
1	FIRE RATED GLASS DOOR AND SIDELITES
2	OUTLINE OF STRUCTURE ABOVE
3	OPEN TO BELOW
4	REQUIRED EXIT STAIR
5	CONVENIENCE STAIR
8	SINGLE PLY ADHERED ROOF <SPA-1>
9	MODIFIED BITUMEN ROOFING <MBR-1>,TYP.
10	COMPOSITE METAL PANEL <MP-1>
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RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

FIRST LEVEL FLOOR PLAN

DATE: JULY 06, 2017

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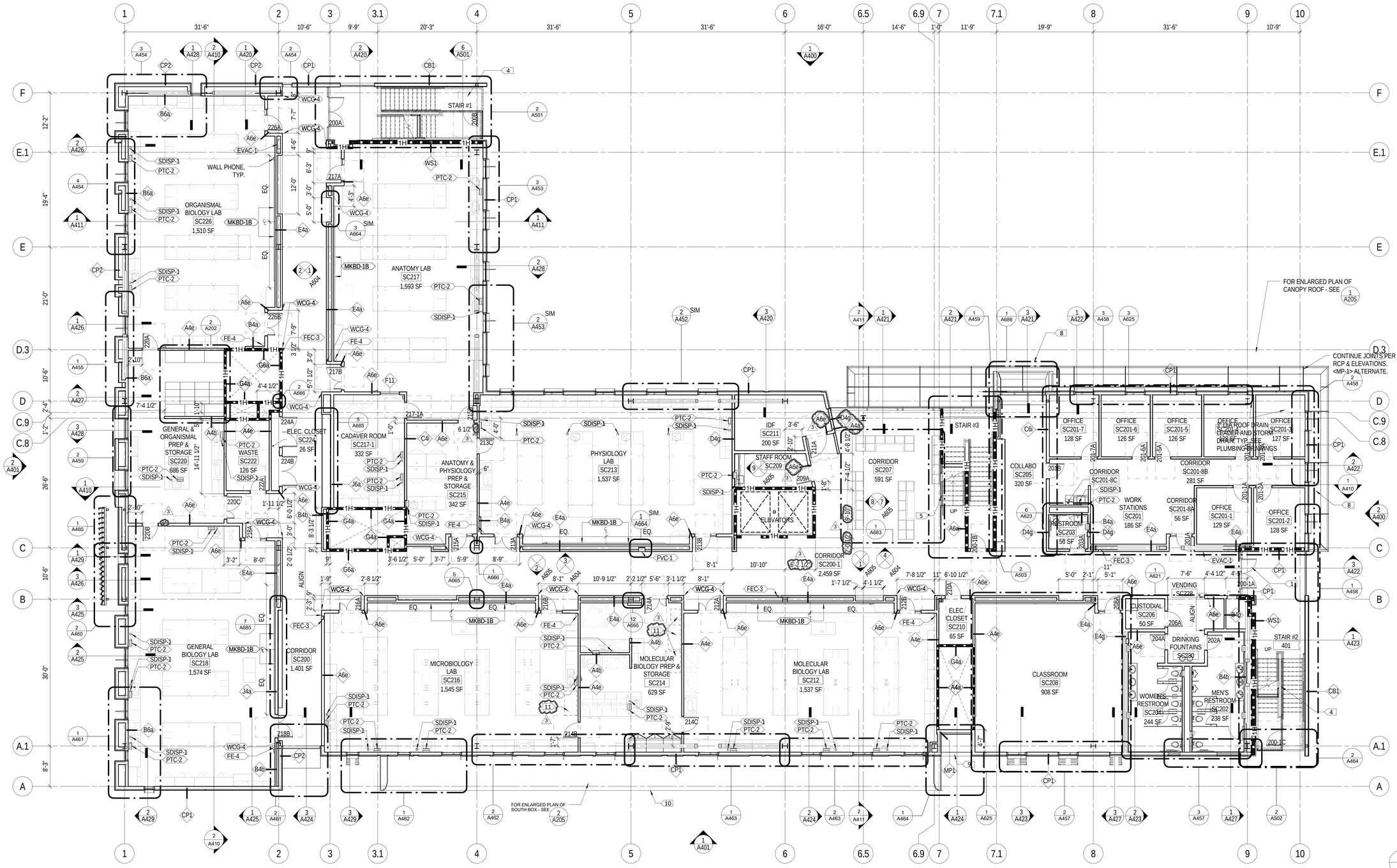
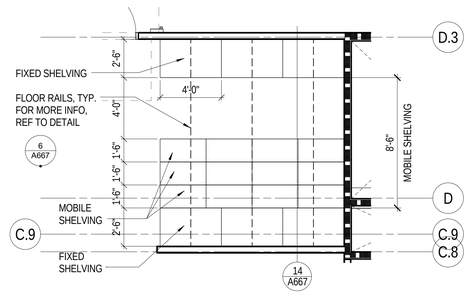
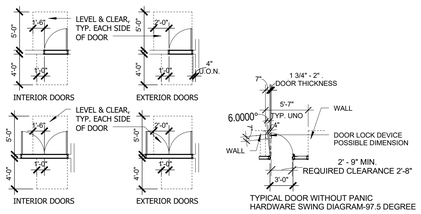


1 FLOOR PLAN - LEVEL 02
1/8" = 1'-0"



2 ENLARGED PLAN OF HIGH DENSITY STORAGE
1/4" = 1'-0"

TYPICAL CLEARANCE AT DOORS



TYPICAL DOOR WITHOUT PANIC HARDWARE SWING DIAGRAM-97.5 DEGREE

FLOOR PLAN LEGEND

WALL RATINGS
1H — 1 HR RATED CONSTRUCTION RATING

NOTES AND SYMBOLS
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JAMES G. MATSON — No. C13036 — Registered Architect — Expiration Date: 11/30/2019 — State of California

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS — REVIEW BY: Approver

HGA NO: 3584-001-00

SECOND LEVEL FLOOR PLAN

DATE: JULY 06, 2017

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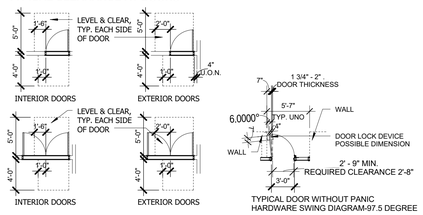
1 FLOOR PLAN - LEVEL 03
1/8" = 1'-0"

TYPICAL CLEARANCE AT DOORS



FLOOR PLAN LEGEND

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1H — 1 HR RATED CONSTRUCTION RATING

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JAMES G. MATSON — LICENSED ARCHITECT — No. C13036 — RENEWAL DATE SEPTEMBER 30, 2019 — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

THIRD LEVEL FLOOR PLAN

DATE: JULY 06, 2017

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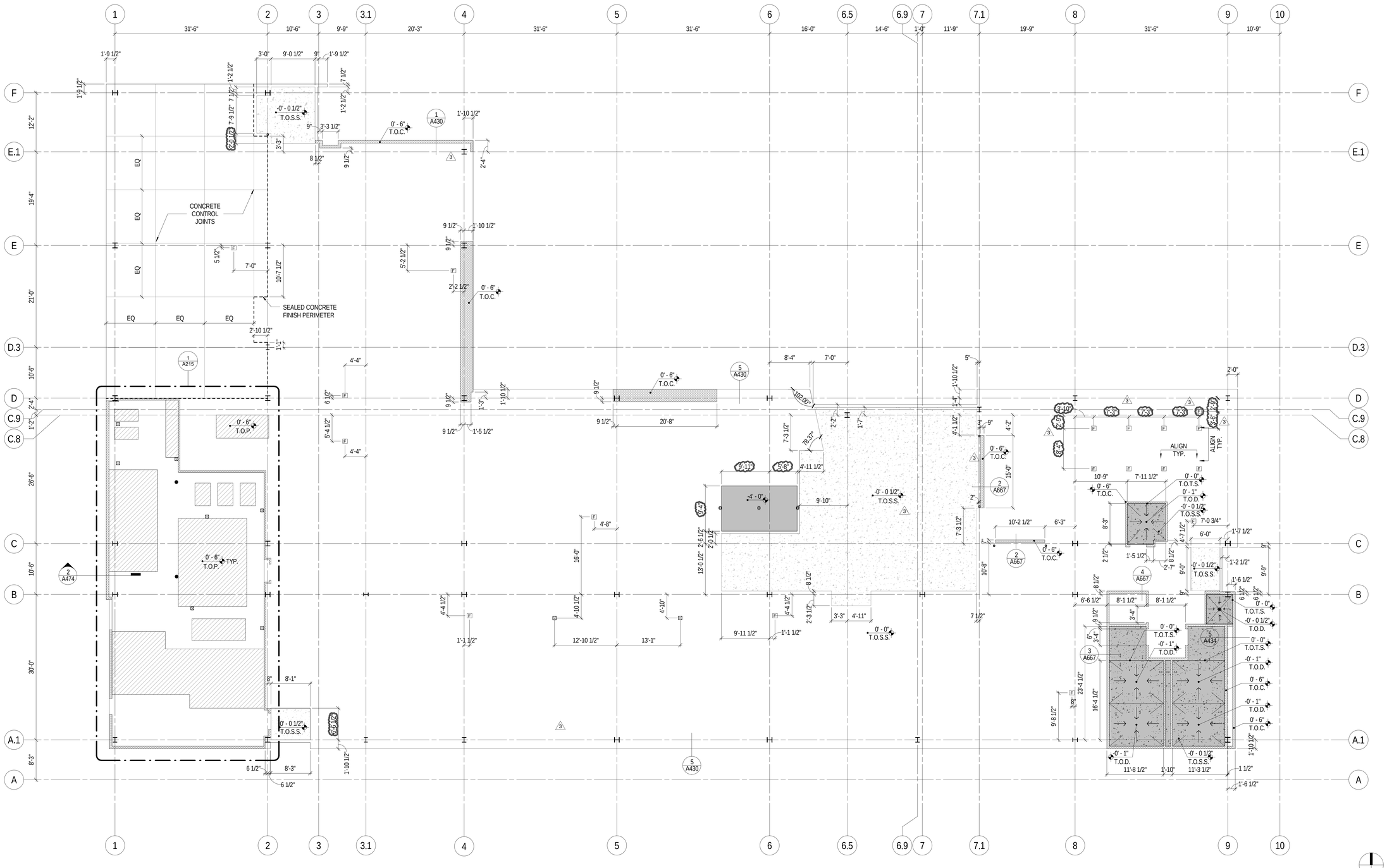

1 SLAB EDGE PLAN - LEVEL 01
1/8" = 1'-0"

SLAB PLAN LEGEND

NOTE:
1. EDGE OF SLAB CONDITION AT EXPOSED SLAB EDGE VARIES - SEE BUILDING ELEVATIONS AND DETAILS
2. TYPICAL STRUCTURAL SLAB DEPRESSION AT TOPPING SLAB LOCATIONS = -2" U.O.N.
3. ALL SLOPES ON WALKABLE SURFACES SHALL BE A MAXIMUM 2%
4. SLAB PLANS ARE INTENDED TO SHOW PRIMARY CURBS, DEPRESSIONS AND PENETRATIONS ON EACH FLOOR AND ROOF LEVELS. HOWEVER THEY ARE NOT INTENED TO BE AN EXHAUSTIVE REPRESENTATION OF EVERY PENETRATION NECESSARY TO ACCOMODATE ALL LINES, UTILITIES, FLOOR BOXES, POKE THROUGHS, ETC FOR MEP, AV, IT, LAB MEP, ETC.
5. DIMENSIONS AT FLOOR BOXES SHOWN ON ALL SLAB PLANS ARE APPROXIMATE. CONTRACTOR TO COORDINATE EXACT LOCATION OF FLOOR BOXES WITH APPROVED FURNITURE PLANS, TYP. ON ALL LEVELS.

- STRUCTURAL CONCRETE SLAB OR SLAB ON GRADE PER STRUCTURAL DRAWINGS
- SLAB OPENING
- CONCRETE PAD - SEE PLAN FOR HEIGHT
- DIRECTION OF DOWN SLOPE
- SLOPED TOPPING SLAB OVER STRUCTURAL SLAB. SEE PLANS FOR POINT ELEVATIONS
- TOP OF TOPPING SLAB, TYPICAL EACH SIDE, U.O.N.
- STRUCTURAL CONCRETE SLAB - 48" DEPRESSION REQUIRED FOR ELEVATOR PIT
- STRUCTURAL CONCRETE SLAB - SEE PLAN FOR DEPRESSION REQUIRED FOR FLOOR FINISH
- CONCRETE CURB - WIDTH TO MATCH WALL STUD SIZE ABOVE, U.O.N.
- BUILDING CONTROL POINT - SEE CIVIL DRAWINGS
- POINT ELEVATION
- FLOOR DRAIN PER PLUMBING DRAWINGS
- FLOOR SINK PER PLUMBING DRAWINGS
- FLOOR BOX PER AV DRAWINGS

T.O.S.S. TOP OF STRUCTURAL SLAB
T.O.T.S. TOP OF TOPPING SLAB
T.O.D. TOP OF DRAIN
T.O.C. TOP OF CURB
T.O.P. TOP OF PAD

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HGA NO: 3584-001-00

FIRST LEVEL SLAB PLAN

DATE: JULY 06, 2017

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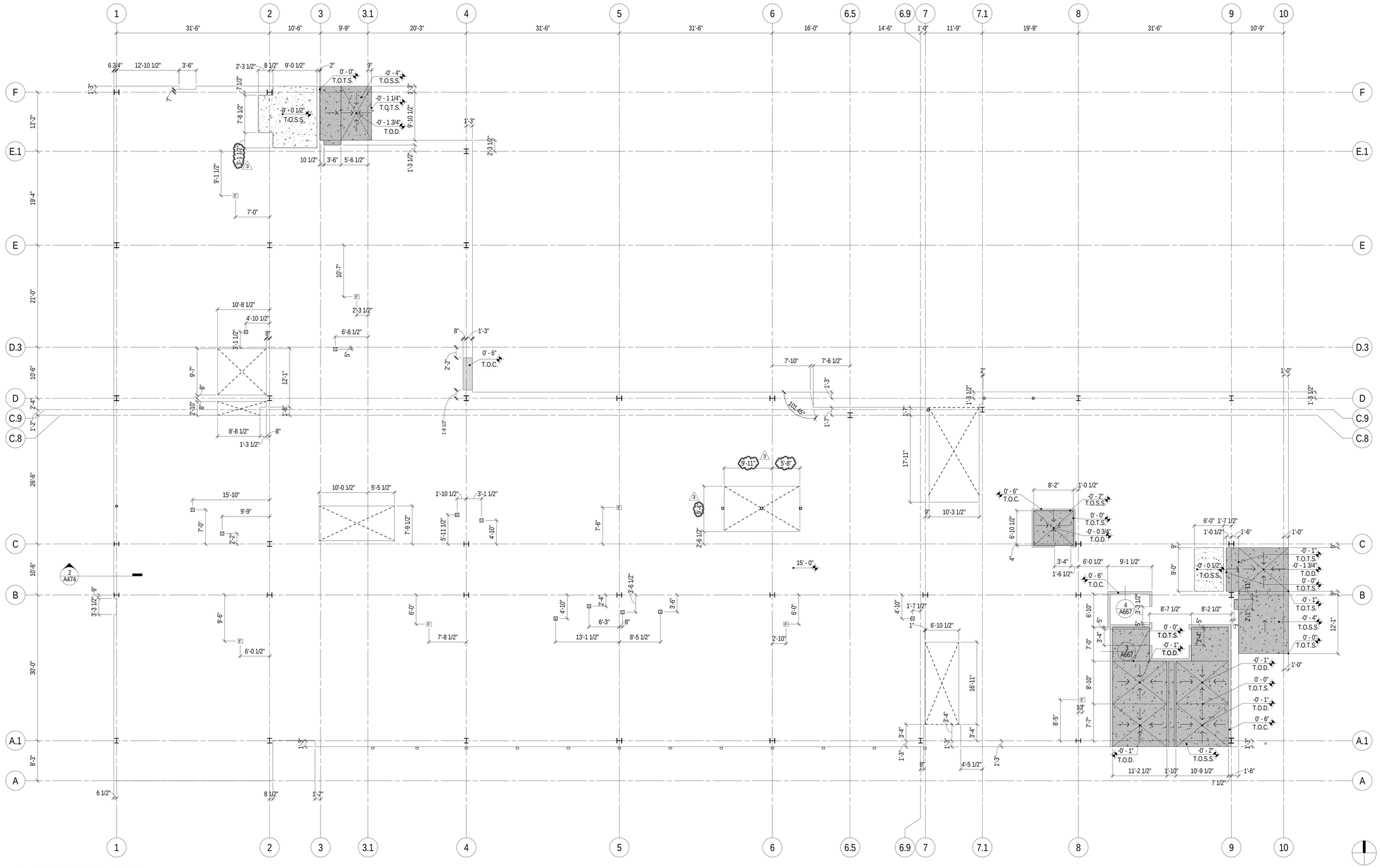

1 SLAB EDGE PLAN - LEVEL 02
1/8" = 1'-0"

SLAB PLAN LEGEND

NOTE:
1. EDGE OF SLAB CONDITION AT EXPOSED SLAB EDGE VARIES - SEE BUILDING ELEVATIONS AND DETAILS
2. TYPICAL STRUCTURAL SLAB DEPRESSION AT TOPPING SLAB LOCATIONS = -2" U.O.N.
3. ALL SLOPES ON WALKABLE SURFACES SHALL BE A MAXIMUM 2%
4. SLAB PLANS ARE INTENDED TO SHOW PRIMARY CURBS, DEPRESSIONS AND PENETRATIONS ON EACH FLOOR AND ROOF LEVELS. HOWEVER THEY ARE NOT INTENED TO BE AN EXHAUSTIVE REPRESENTATION OF EVERY PENETRATION NECESSARY TO ACCOMODATE ALL LINES, UTILITIES, FLOOR BOXES, POKE THROUGHS, ETC FOR MEP, AV, IT, LAB MEP, ETC.
5. DIMENSIONS AT FLOOR BOXES SHOWN ON ALL SLAB PLANS ARE APPROXIMATE. CONTRACTOR TO COORDINATE EXACT LOCATION OF FLOOR BOXES WITH APPROVED FURNITURE PLANS, TYP. ON ALL LEVELS.

- STRUCTURAL CONCRETE SLAB OR SLAB ON GRADE PER STRUCTURAL DRAWINGS
- SLAB OPENING
- CONCRETE PAD - SEE PLAN FOR HEIGHT
- DIRECTION OF DOWN SLOPE
- SLOPED TOPPING SLAB OVER STRUCTURAL SLAB. SEE PLANS FOR POINT ELEVATIONS
- TOP OF TOPPING SLAB, TYPICAL EACH SIDE, U.O.N.
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- CONCRETE CURB - WIDTH TO MATCH WALL STUD SIZE ABOVE, U.O.N.
- BUILDING CONTROL POINT - SEE CIVIL DRAWINGS
- - 2 1/2" T.O.S.S. POINT ELEVATION
- FLOOR DRAIN PER PLUMBING DRAWINGS
- FLOOR SINK PER PLUMBING DRAWINGS
- F FLOOR BOX PER AV DRAWINGS

T.O.S.S. TOP OF STRUCTURAL SLAB
T.O.T.S. TOP OF TOPPING SLAB
T.O.D. TOP OF DRAIN
T.O.C. TOP OF CURB
T.O.P. TOP OF PAD

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SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

SECOND LEVEL SLAB PLAN

DATE: JULY 06, 2017

A212

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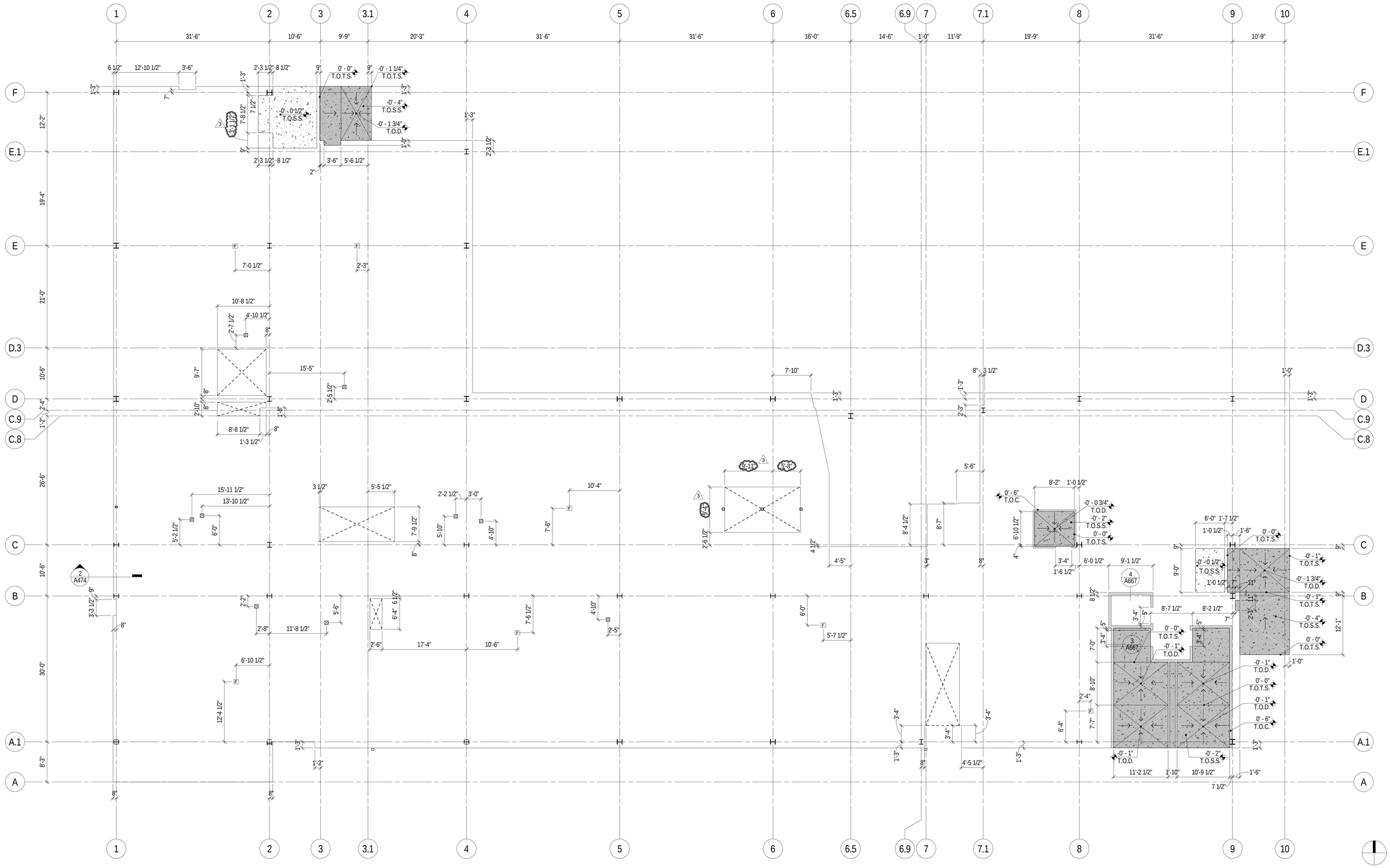

1 SLAB EDGE PLAN - LEVEL 03
1/8" = 1'-0"

SLAB PLAN LEGEND

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3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

THIRD LEVEL SLAB PLAN

DATE: JULY 06, 2017

A213

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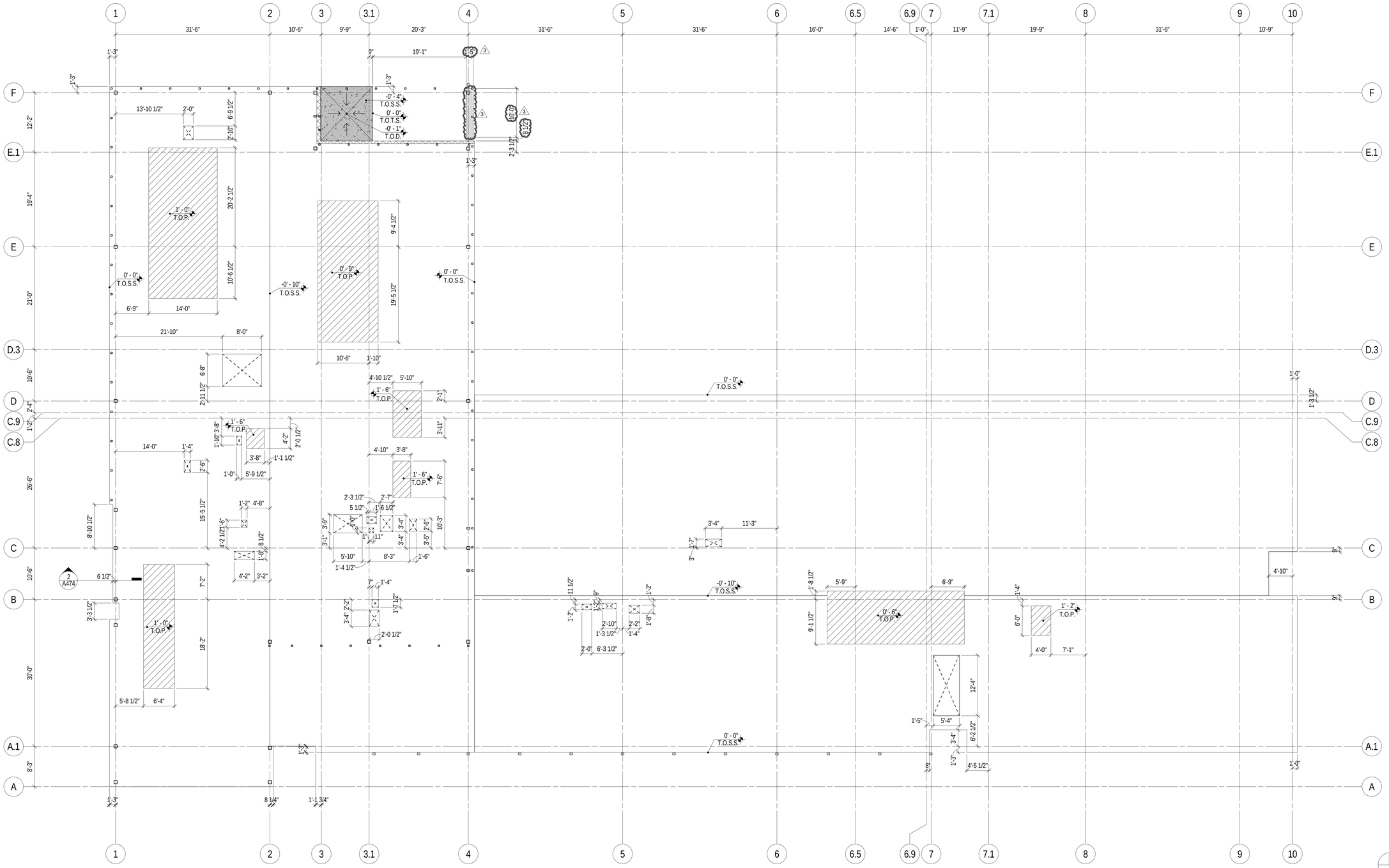

SLAB PLAN LEGEND

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: Approver

HGA NO: 3584-001-00

ROOF SLAB PLAN

DATE: JULY 06, 2017

A214

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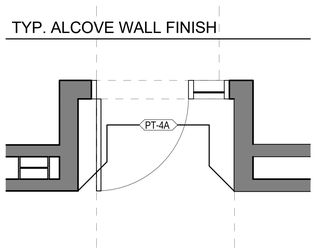
1 FLOOR FINISH PLAN - LEVEL 01
1/8" = 1'-0"

TYP. ALCOVE WALL FINISH



FINISH PLAN LEGEND

= TER-3
= TER-4
= CS-2
= RSF-1
= RSF-2
= CPT-50
= CPT-1

KEYNOTES - FINISH PLAN

#	DESCRIPTION
1	GYPSUM BOARD TO RECEIVE LEVEL 5 FINISH AT THIS LOCATION.
2	SPECIALTY ACOUSTIC WALL PANEL DESIGN. SEE ELEVATION FOR DETAIL.
3	CTW TO EXTEND FROM CTB TO 6'-8" A.F.F. UON.
4	SEE STAIR DETAILS FOR TERRAZZO DESIGN AT THIS LOCATION.
5	PROVIDE CHAIR RAIL <WR-1> ACROSS FULL WIDTH OF WALL. REFER TO INTERIOR ELEVATIONS FOR MORE INFO.
6	INSTALL 3/4" PLYWOOD ON ALL WALLS TO 8'-0" A.F.F. PAINT PER FINISH SCHEDULE.

GENERAL NOTES - FLOOR FINISH PLAN

A. SEE SHEET A011 - MATERIAL ID CODES FOR ADDITIONAL FINISH INFORMATION.
B. ALL MISCELLANEOUS ACCESS PANELS, FEC, GRILLES, DIFFUSERS TO BE PAINTED TO MATCH THE SURFACE ON WHICH THEY OCCUR.
C. ALL EXPOSED STRUCTURE TO BE PAINTED <PT-1D UON, TYP.> 3
D. FLOOR MATERIAL TRANSITIONS TO OCCUR AT CENTERLINE OF DOOR UON.
E. RB - RESILIENT BASE: STRAIGHT BASE (RB-2) AT CARPET, COVED BASE (RB-1) AT HARD FLOOR FINISHES (RSF, TER, CS).
F. THE BASE AT LOWER CABINETS TO MATCH THE WALL BASE OF THE ROOM IN WHICH IT OCCURS UON IN MILLWORK DETAILS.
G. ALL CONCRETE CURBS TO RECEIVE THE WALL BASE OF THE ROOM IN WHICH IT OCCURS UON.
H. ALL WALLS TO BE PAINTED <PT-1A> UNO, TYP. CORRIDOR WALLS TO BE PAINTED <PT-1A> ABOVE AND <PT-2A> BELOW HORIZONTAL RUNNING GYP TRIM UNO, TYP. 3

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3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: AD | REVIEW BY: Approver

HGA NO: 3584-001-00

FIRST LEVEL FINISH PLAN

DATE: JULY 06, 2017

A221

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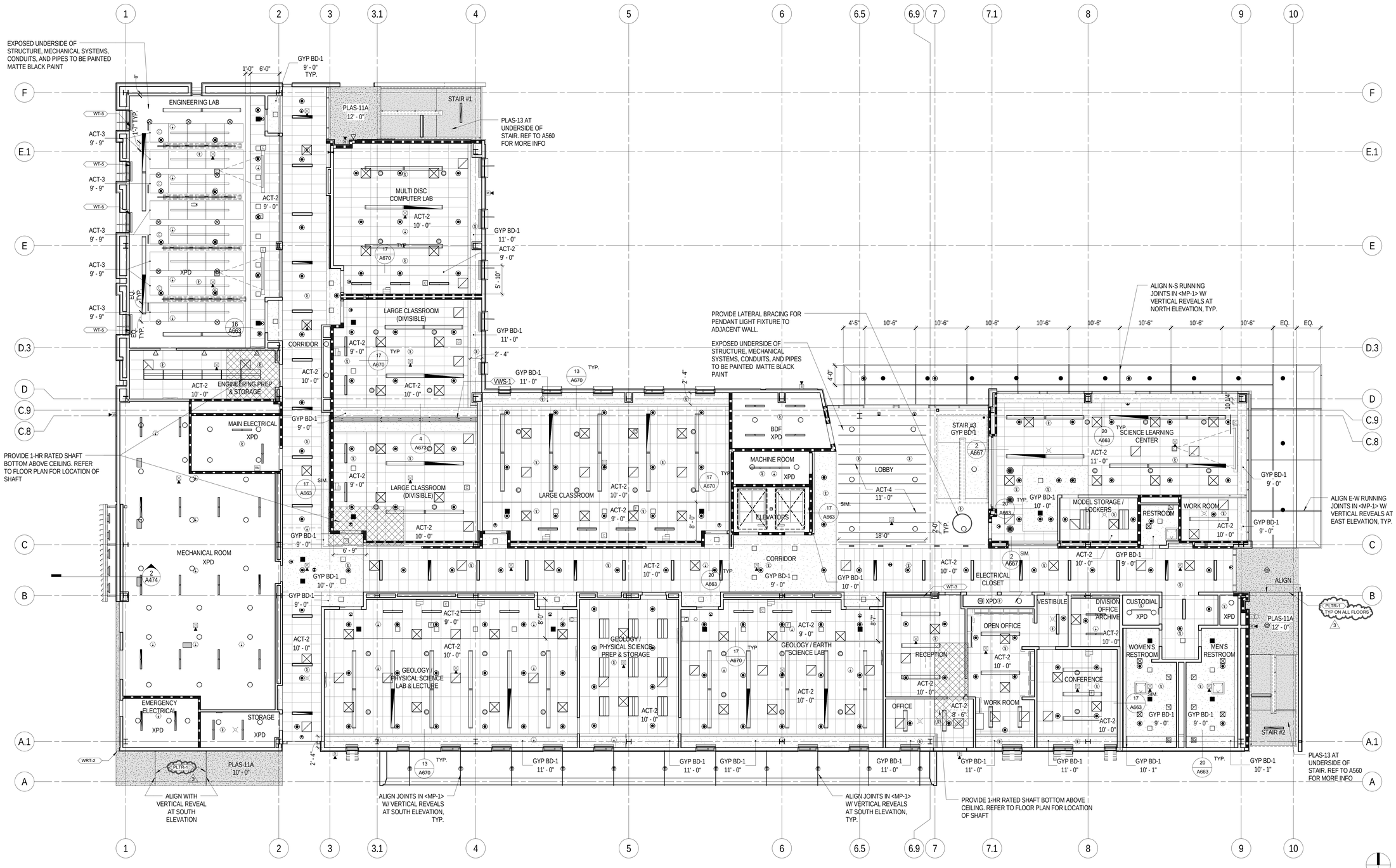

1 REFLECTED CEILING PLAN - LEVEL 01
1/8" = 1'-0"

REFLECTED CEILING PLAN LEGEND

- PLASTER SOFFIT PER 21/A663 (PLAS-11A) (PLAS-11B) OR (PLAS-13) (PLTR-1) 3
- FRAMED GYPSUM BOARD CEILING (GYP BD-1) PER 8/A663
- SUSPENDED 2'x4' ACOUSTICAL PANEL CEILING (ACT-2) PER 1/A670
- SUSPENDED 4'x4' ACOUSTICAL CLOUDS (ACT-3) PER 5/A671
- SUSPENDED METAL BAFFLES (ACT-4) PER 6/A671
- SUSPENDED WOOD CEILING (ACT-5) PER 1/A671
- XPD — NO CEILING / EXPOSED TO STRUCTURE
- OPEN — FOR BOTTOM OF 1-HOUR RATED SHAFT ENCLOSURE, SEE 7/A661

- SUSPENDED 6" ACOUSTICAL BAFFLES, VARYING LENGTHS (ASB-1)
- A2, A3 — PENDENT LIGHTING FIXTURE, SIZES VARY, SEE ELECTRICAL DWGS FOR MORE INFO.
- C1 — 2' x 4' RECESSED LIGHTING FIXTURE
- CL1, CL2 — COVE LIGHT, SIZES VARY
- D1 — 6" RECESSED DOWNLIGHT
- DL1 — CYLINDER DOWNLIGHT
- E1 — CEILING-MOUNTED STRIP LIGHT
- F1 — COVE LIGHTING FIXTURE
- G1 — 4.5" x 4.5" RECESSED DOWNLIGHT
- J1, J2 / JL1 — LONG WALL-MOUNTED LIGHTING FIXTURE, SIZES VARY, SEE ELECTRICAL DWGS FOR MORE INFO. / LINEAR WALL-MOUNTED LIGHTING FIXTURE
- K1 — WALL-MOUNTED LIGHTING FIXTURE
- N1 — RECESSED EXTERIOR DOWNLIGHT
- M1 — 48" LONG WALL-MOUNTED LIGHTING FIXTURE
- 12'-0" RECESSED LINEAR LIGHTING FIXTURE
- PL1 — 48" DIAMETER PENDANT LIGHTING FIXTURE
- PL2 — 6" DIAMETER CYLINDER
- Q1 — 16" DIAMETER PENDANT LIGHTING FIXTURE
- S1 — EXTERIOR WALL WASH LIGHTING FIXTURE
- SL1 — CAMPUS WALKWAY LIGHTING FIXTURE
- SL3 — LIGHTING POLE
- SL4 — TREE UPLIGHTS
- SL5 — LIGHT STRIP-FLEXIBLE
- SL6 — CAMPUS PARKING LOT LIGHT FIXTURE- TWIN HEAD

- W1 — CEILING-MOUNTED STRIP LIGHT
- UNDER CABINET LIGHTING
- X1 — CEILING-MOUNTED EXIT SIGN
- X2 — PENDANT EXIT SIGN
- CEILING-MOUNTED HEAT DETECTOR
- CEILING-MOUNTED SMOKE DETECTOR
- ELECTRONIC VISUAL AND SPEAKER DEVICE
- FIRE ALARM HORN
- UPRIGHT SPRINKLER HEAD
- PENDENT SPRINKLER HEAD
- SIDEWALL SPRINKLER HEAD
- CEILING REGISTER/GRILLE FACE
- ACCESS PANEL

- WALL-MOUNTED ULTRA-SHORT THROW PROJECTOR. FOR ANCHORAGE, REF TO 1/AV701
- CEILING RECESSED / PENDANT LOUDSPEAKER
- CEILING-MOUNTED VIDEO PROJECTOR, REF TO DETAIL 1/AV702. FOR ANCHORAGE DETAIL, REF TO 10/S7.20.
- CEILING-MOUNTED PROJECTOR SCREEN, REF TO DETAIL 1/AV702. FOR ANCHORAGE, REF TO DETAIL 5/S7.20.
- PIPE DROP, REFER TO LAB DWGS FOR MORE INFO
- EYE WASH AND SAFETY SHOWER, REFER TO LAB DWGS FOR MORE INFO
- SNORKEL, REFER TO LAB DWGS FOR MORE INFO. FOR ANCHORAGE, REF 8/S7.20
- EXAM LIGHT, REFER TO LAB DWGS FOR MORE INFO. FOR ANCHORAGE, REF 8/S7.20
- FUME HOOD, REFER TO LAB DWGS FOR MORE INFO.

GENERAL NOTES - CEILING PLAN

A. SEE MECHANICAL AND ELECTRICAL DWGS FOR DEVICE AND FIXTURE TYPES, SIZES, QUANTITY, INSTALLATION & SPECIFICATIONS. DEVICES SHOWN ON THE ARCH PLANS & NOT ON ENGINEERING PLANS SHOULD BE BROUGHT TO ARCHITECT'S ATTENTION FOR CLARIFICATIONS.
B. ACT TILES SHALL BE CENTERED WITHIN ROOM(S) U.N.O. FULL CEILING TILE TO BE ALIGNED TO OTHER CEILING TYPES WITHIN THE ROOMS AS INDICATED ON PLANS.
C. CENTER RECESSED LIGHTS, ELECTRICAL, MECHANICAL DEVICES AND SPRINKLER HEADS WHEN SHOWN IN CEILING TILES. WHERE RECESSED LIGHTS ARE SHOWN OFF-CENTER IN 2X4 SCORED CEILING TILE, CENTER THE FIXTURE WITHIN THE 2X2 PORTION OF THE TILE.
D. PROVIDE ACCESS PANEL(S) AS REQUIRED. REVIEW LOCATION OF ACCESS PANEL(S) NOT SHOWN ON THE DRAWINGS WITH ARCHITECT PRIOR TO INSTALLATION.
E. CEILING FINISHES ADJACENT TO OR WITHIN THE LIMITS OF CONSTRUCTION DISTURBED OR DAMAGED BY CONSTRUCTION SHALL BE PATCHED TO MATCH EXISTING ADJACENT CEILING FINISH.
F. ALL <GYP-BD 1> CEILING TO BE PAINTED <PT-1C>. CEILING AT RESTROOMS TO BE PAINTED <PT-1B>.
G. ALL EXTERIOR WINDOWS TO HAVE SINGLE SHADE <WT-3> U.N.O. REFER TO SHEET A441 FOR MANUAL AND AUTOMATIC SHADES DTLS.
H. ACT TILE TO FRAME AROUND FUME HOODS WHERE OCCURS.
I. SHIFT FIXTURES/CEILING-MOUNTED EQUIPMENT IN THE CEILING OUT OF THE WAY WHERE IT INTERFERE WITH JOINTS IN THE CANOPY AND GYP CEILING. BRING TO THE ARCHITECT'S ATTENTION FOR CLARIFICATINOS.
J. BULKHEAD LOCATED AT THE FRONT OF EACH CLASSROOM AND LAB TO RECEIVE <PT-3C> FINISH.
K. ALL FIXTURES, TERMINALS, AND OTHER DEVICES SHALL BE MOUNTED IN A MANNER THAT WILL NOT COMPROMISE CEILING PERFORMANCE IN ACCORDANCE WITH SECTION 13.5.6.2.2 ITEM 5 OF ASCE 7 AS AMENDED BY CBC SECTION 1616A.1.20 (1616.10.16) AND ASTM E580 SECTIONS 5.3 AND 5.4.
L. CEILING PANELS SHALL NOT SUPPORT ANY LIGHT FIXTURES, AIR TERMINALS OR DEVICES.
M. PENETRATIONS THROUGH THE CEILING FOR SPRINKLER HEADS AND OTHER SIMILAR DEVICES THAT ARE NOT INTEGRALLY TIED TO THE CEILING SYSTEM IN THE LATERAL DIRECTION SHALL HAVE A TWO (2) INCH OVERSIZED RING, SLEEVE OR ADAPTERTHROUGH THE CEILING TILE TO ALLOW FREE MOVEMENT OF ONE (1) INCH IN ALL HORIZONTAL DIRECTIONS. ALTERNATIVELY, PER ASTM E580, SECTION 5.2.8.5, A FLEXIBLE SPRINKLER HOSE FITTING THAT CAN ACCOMMODATE ONE (1) INCH OF CEILING MOVEMENT SHALL BE PERMITTED TO BE USED IN LIEU OF THE OVERSIZED RING, SLEEVE, OR ADAPTER.
N. SLACK SAFETY WIRES SHALL BE CONSIDERED HANGER WIRES FOR INSTALLATION AND TESTING REQUIREMENTS.
O. REF TO DETAIL 5/A673 FOR PENDANT LIGHT FIXTURE MOUNTING AND ANCHORAGE DETAILS.

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IRVINE, CA 92614
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RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

LICENSED ARCHITECT JAMES G. MATSON No. C13036 RENEWAL DATE SEPTEMBER 30, 2019 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
1	Addendum 1	8/23/17
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: SK | REVIEW BY: Approver

HGA NO: 3584-001-00

FIRST LEVEL REFLECTED CEILING PLAN

DATE: JULY 06, 2017

A301

ADDENDA PACKAGE

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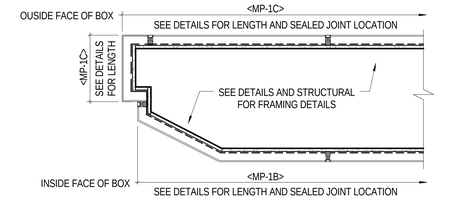
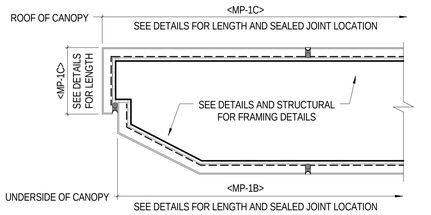
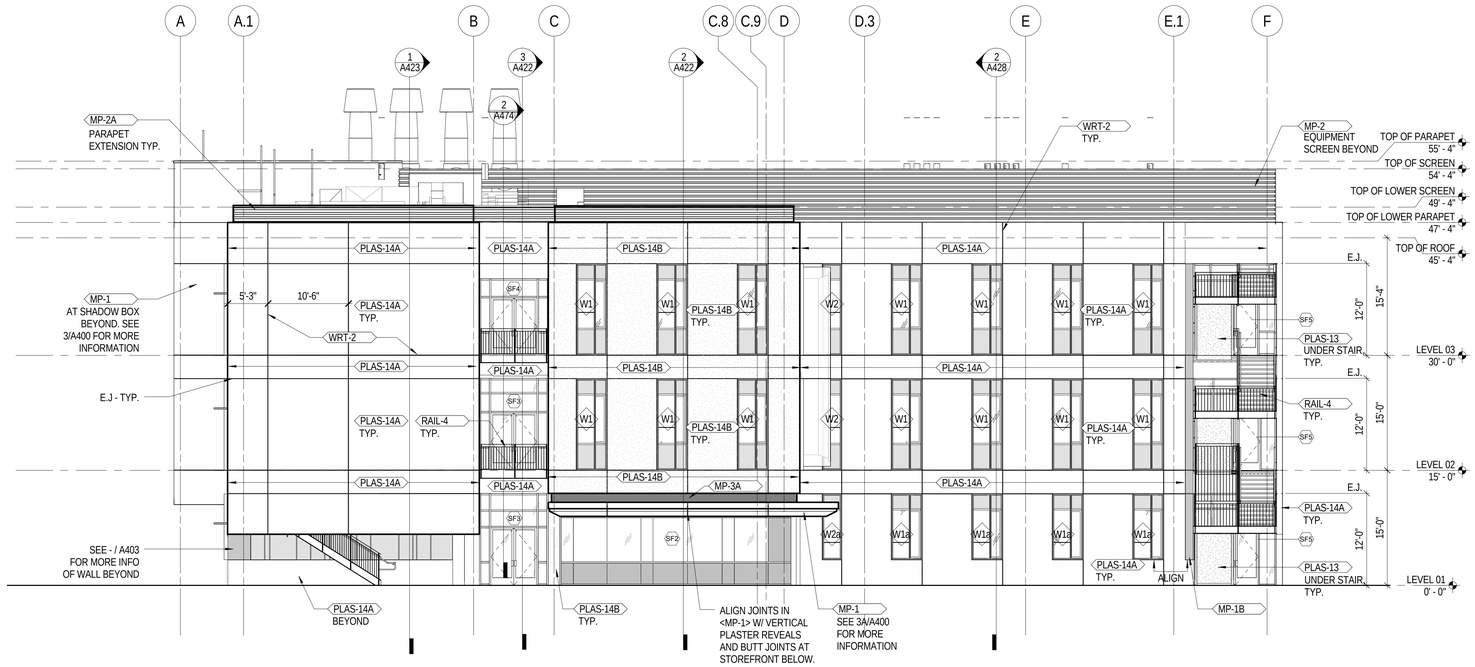


B NORTH/SOUTH BOX

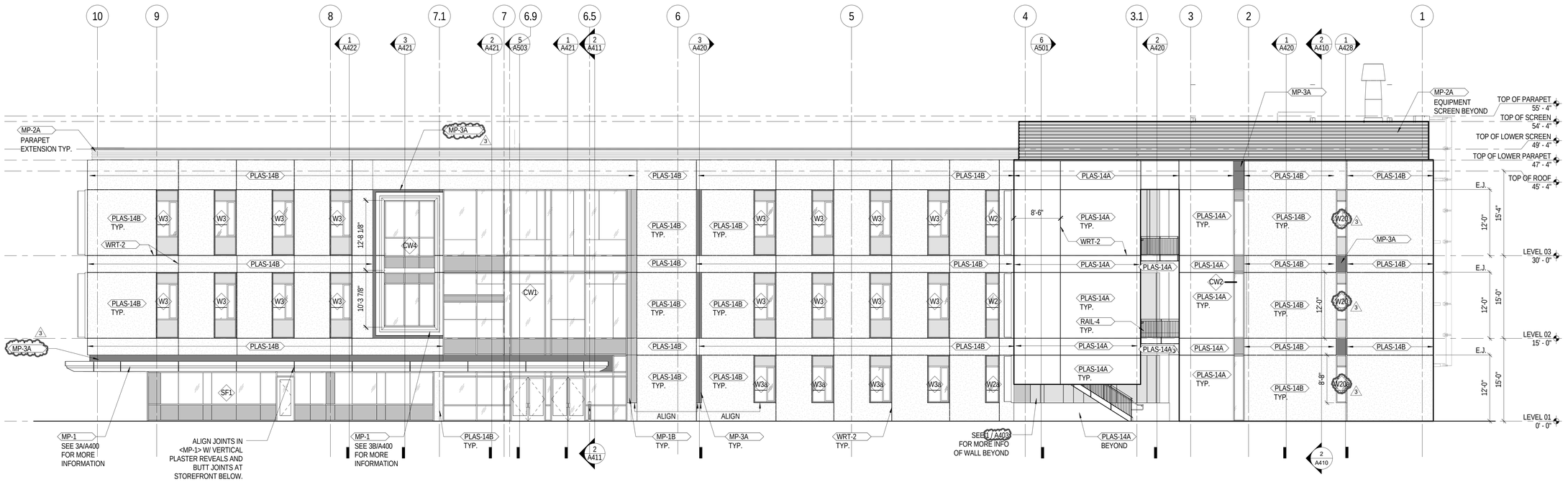


A CANOPY

3 MP-1 MATERIALITY FOR CANOPY AND BOX
NTS



2 EAST ELEVATION
1/8" = 1'-0"



1 NORTH ELEVATION
1/8" = 1'-0"

1918 Main Street, Third Floor
Santa Monica , California 90405
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NAME: JAMES G. MATSON
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3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

EXTERIOR ELEVATIONS (NORTH & EAST)

DATE: JULY 06, 2017

A400 ADDENDA PACKAGE

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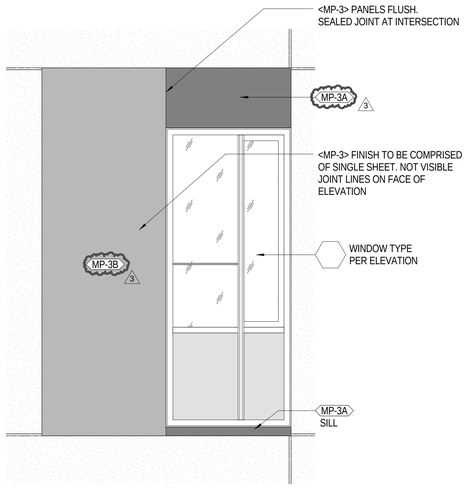
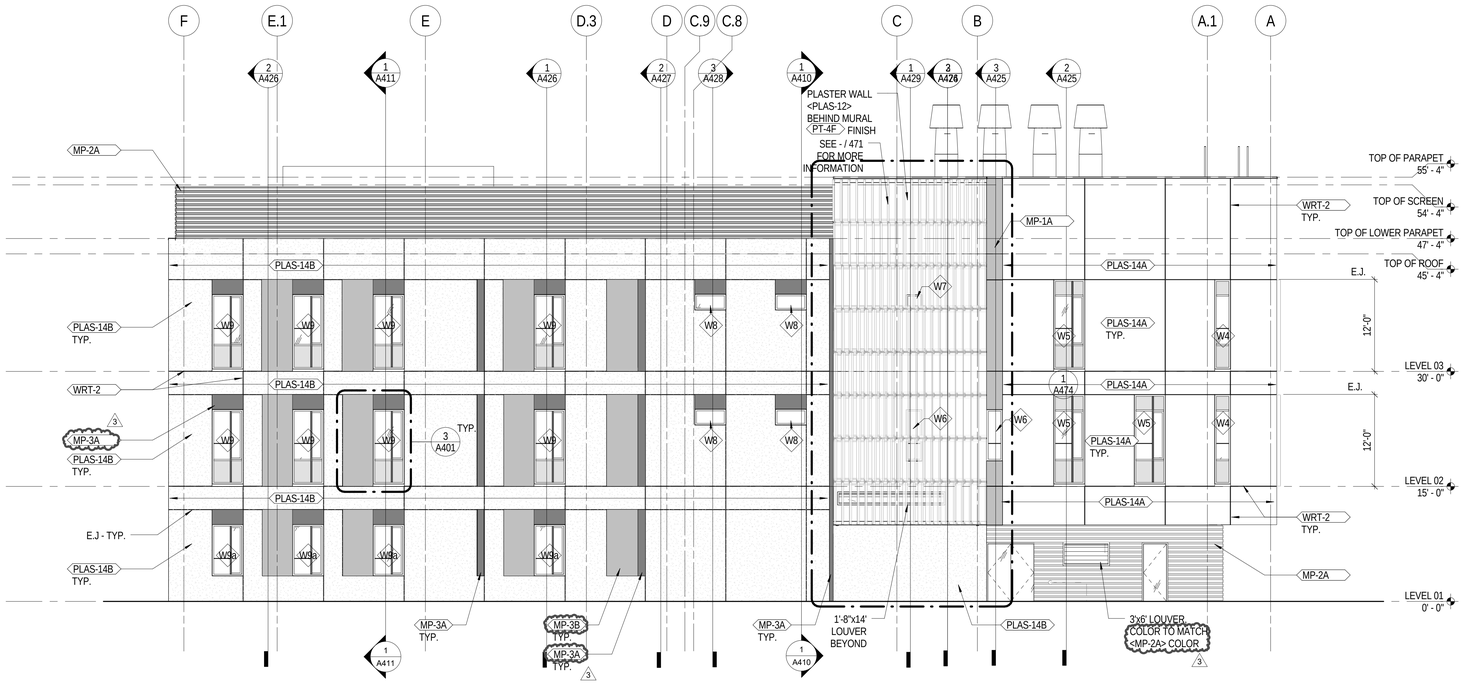
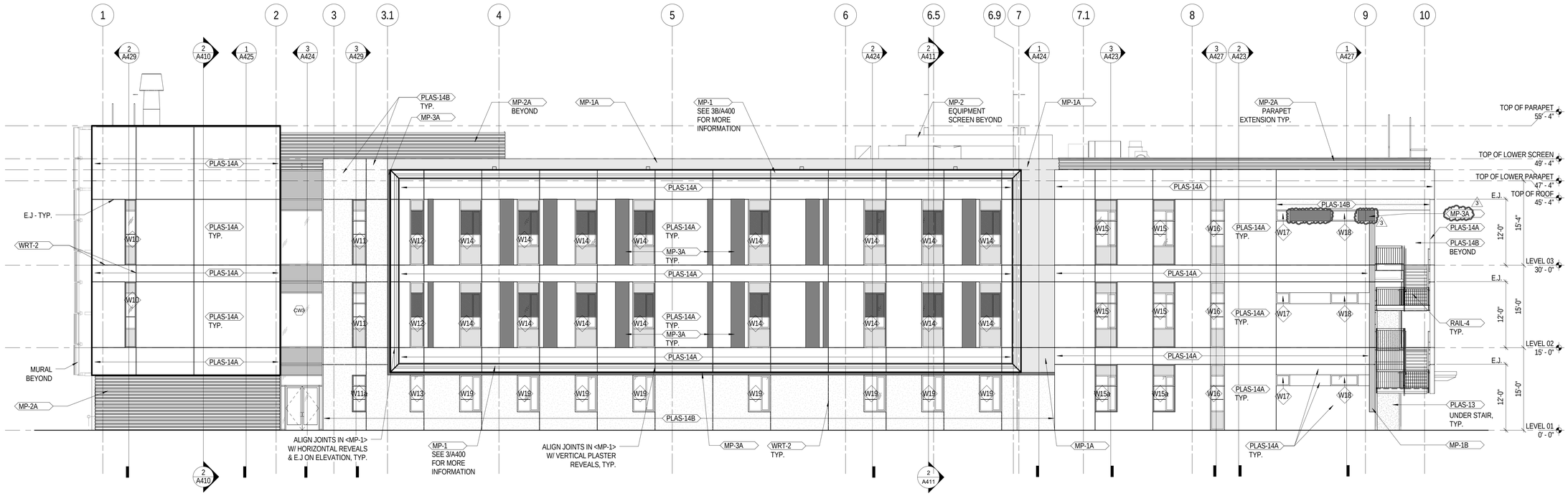


3 MP-3 PANEL AT WINDOW
1/2" = 1'-0"



2 WEST ELEVATION
1/8" = 1'-0"



1 SOUTH ELEVATION
1/8" = 1'-0"

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NO	DESCRIPTION	DATE
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ISSUANCE HISTORY - THIS SHEET
DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

EXTERIOR ELEVATIONS (SOUTH & WEST)

DATE: JULY 06, 2017

A401

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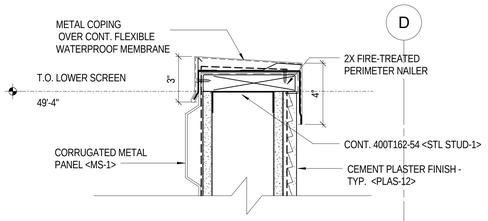
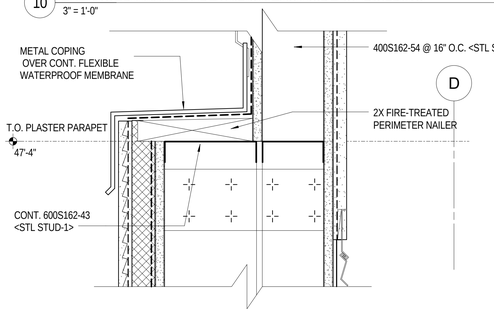
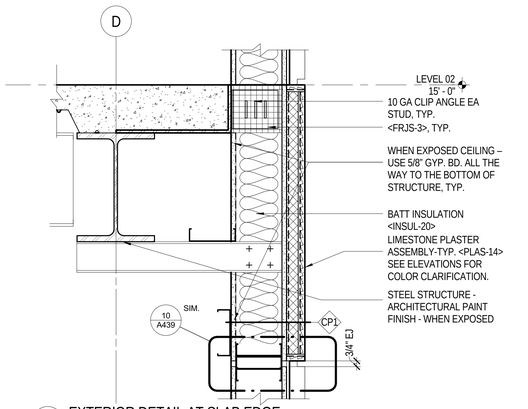


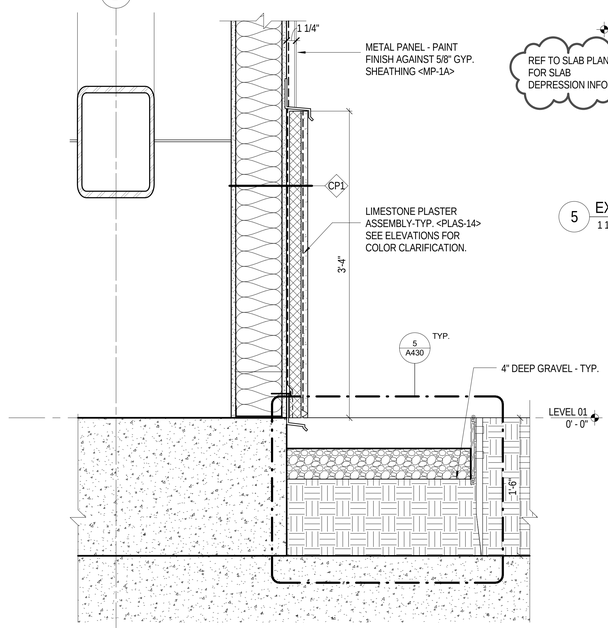
10 ENLARGED PARAPET DETAIL ON EAST SIDE OF BUILDING
3" = 1'-0"



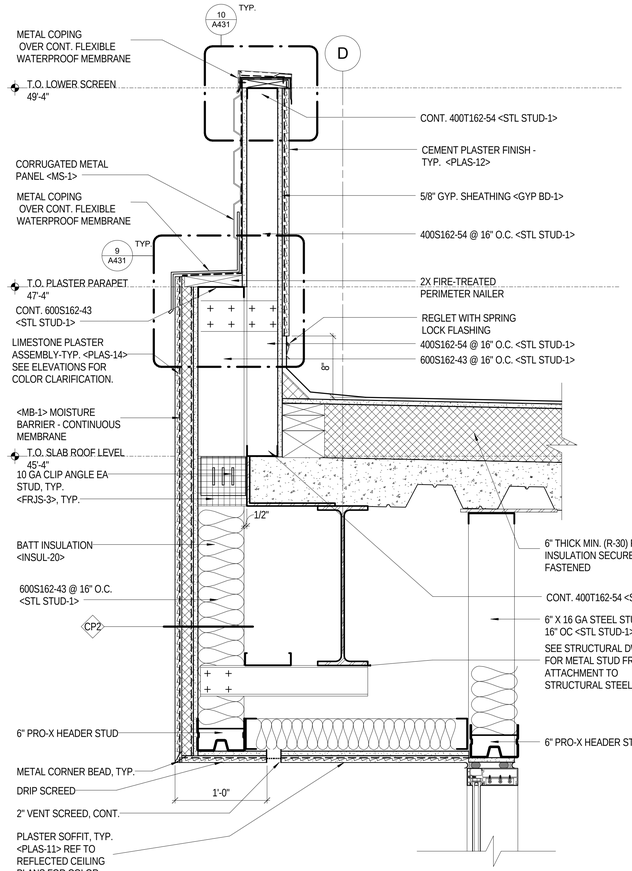
9 ENLARGED PARAPET DETAIL ON EAST SIDE OF BUILDING
3" = 1'-0"



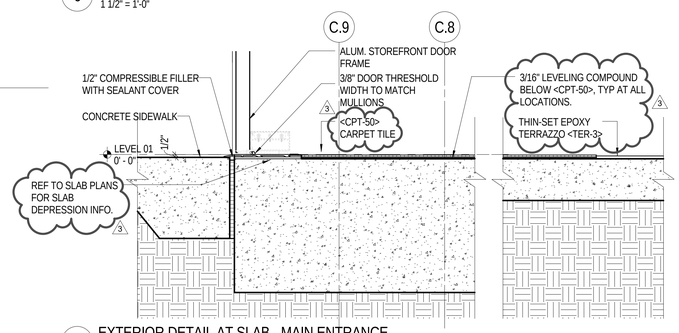
8 EXTERIOR DETAIL AT SLAB EDGE
1 1/2" = 1'-0"



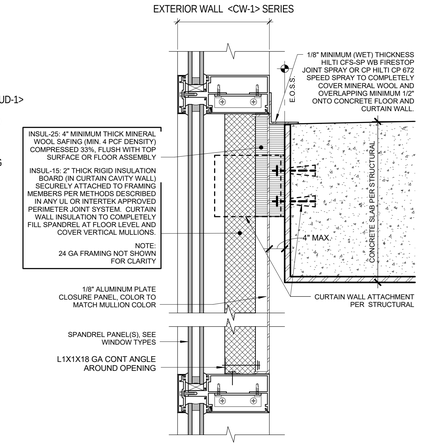
7 EXTERIOR DETAIL AT SLAB
1 1/2" = 1'-0"



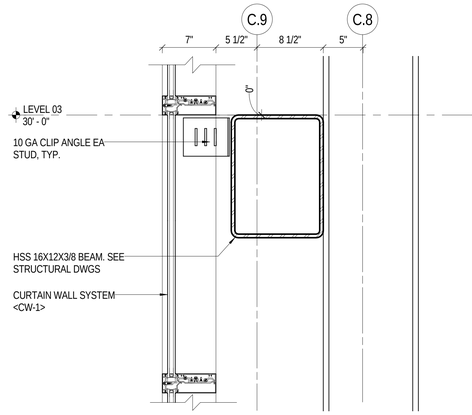
6 PARAPET DETAIL ON EAST SIDE OF BUILDING
1 1/2" = 1'-0"



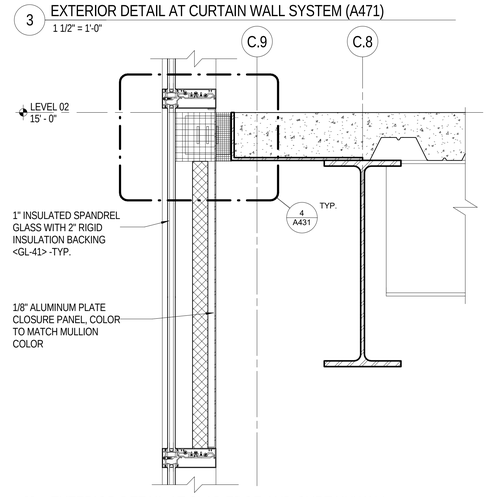
5 EXTERIOR DETAIL AT SLAB - MAIN ENTRANCE
1 1/2" = 1'-0"



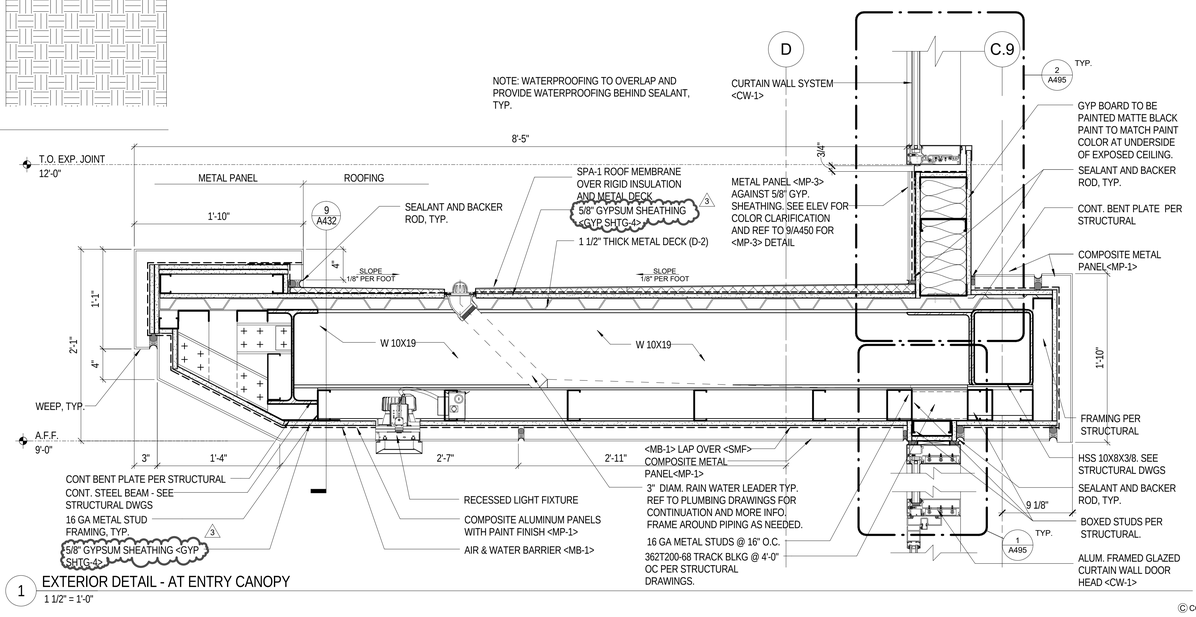
4 EXT. WALL CW-1 SERIES AT FL. SLAB (1 HR FIRE-RATED)
3" = 1'-0"



3 EXTERIOR DETAIL AT CURTAIN WALL SYSTEM (A471)
1 1/2" = 1'-0"



2 EXTERIOR DETAIL AT SLAB EDGE AND CURTAINWALL
1 1/2" = 1'-0"



1 EXTERIOR DETAIL - AT ENTRY CANOPY
1 1/2" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON C-13036 STATE OF CALIFORNIA
SEPTEMBER 30, 2017 RENEWAL DATE

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
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3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

EXTERIOR
SECTION
DETAILS

DATE: JULY 06, 2017

A431

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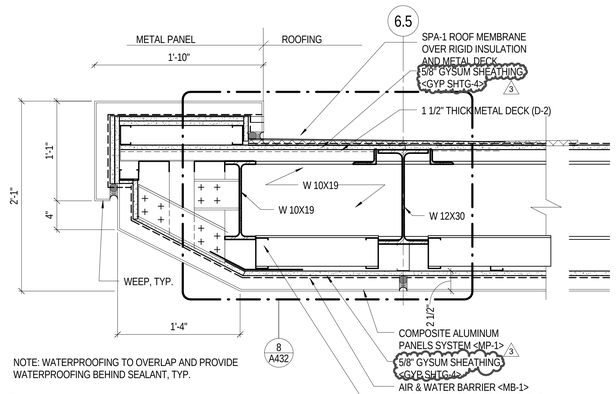
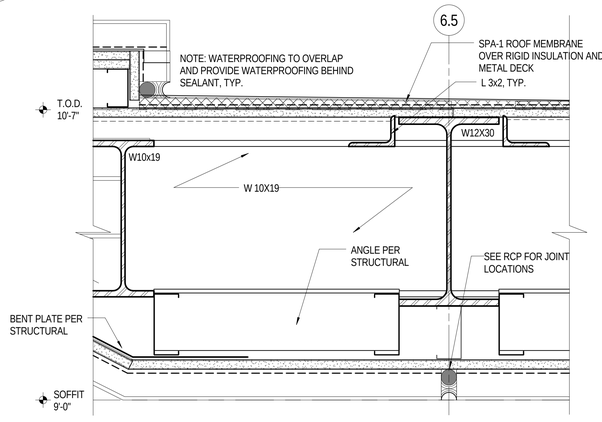


NOTE: WATERPROOFING TO OVERLAP AND PROVIDE WATERPROOFING BEHIND SEALANT, TYP.

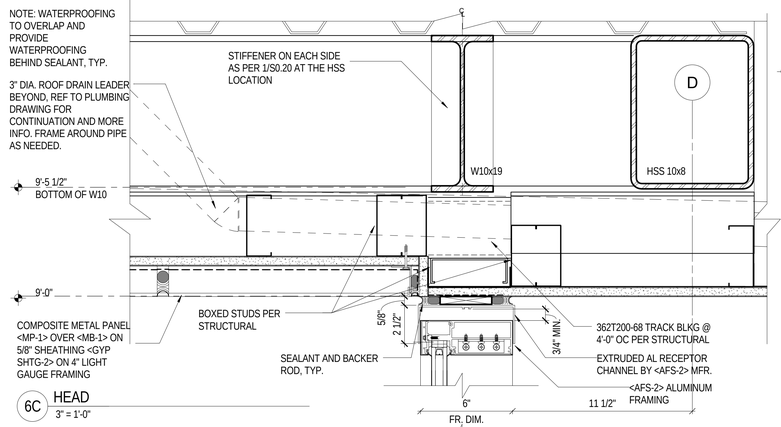
9 EXTERIOR DETAIL - CANOPY
1 1/2" = 1'-0"



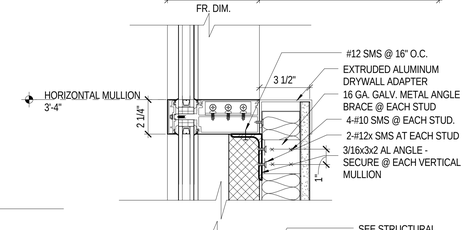
8 ENLARGED DETAIL - CANOPY AT THE ENTRANCE
3" = 1'-0"

NOTE: WATERPROOFING TO OVERLAP AND PROVIDE WATERPROOFING BEHIND SEALANT, TYP.

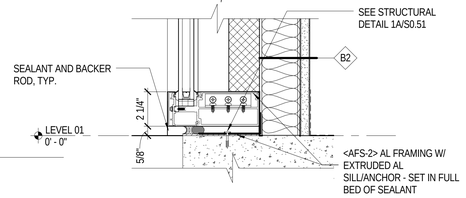
3" DIA. ROOF DRAIN LEADER BEYOND, REF TO PLUMBING DRAWING FOR CONTINUATION AND MORE INFO. FRAME AROUND PIPE AS NEEDED.



6C HEAD
3" = 1'-0"

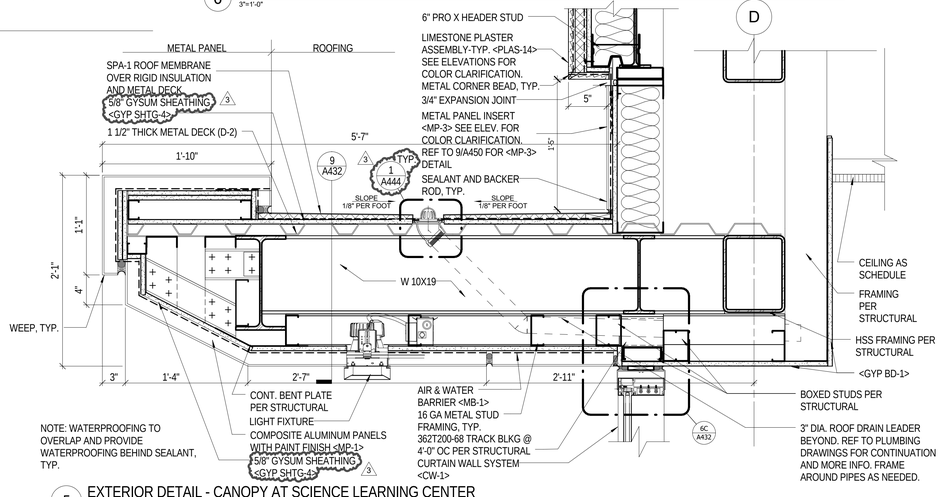


6B HORIZONTAL MULLION
3" = 1'-0"

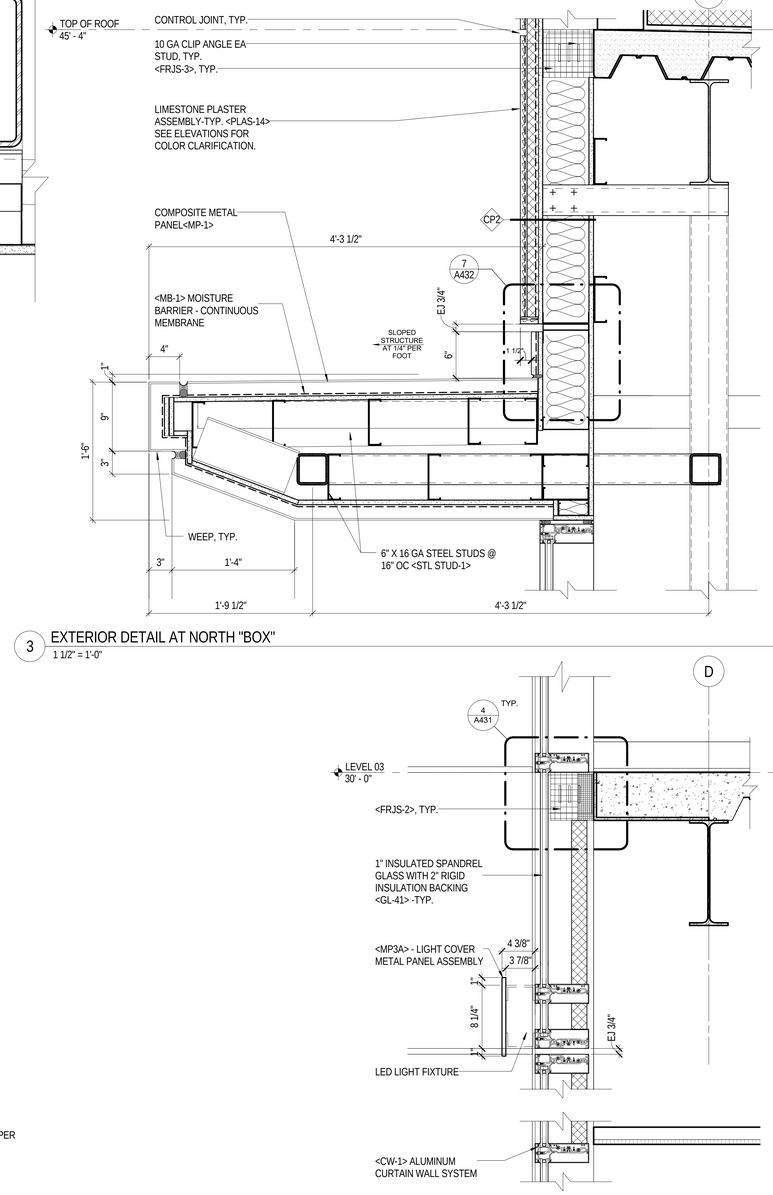


6A SILL
3" = 1'-0"

6 AFS-2 DETAILS
3"=1'-0"

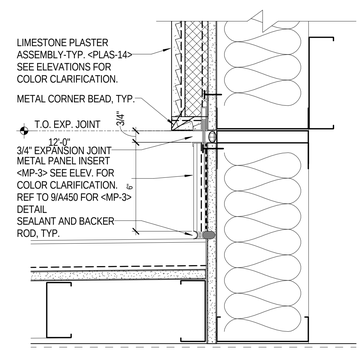


5 EXTERIOR DETAIL - CANOPY AT SCIENCE LEARNING CENTER
1 1/2" = 1'-0"

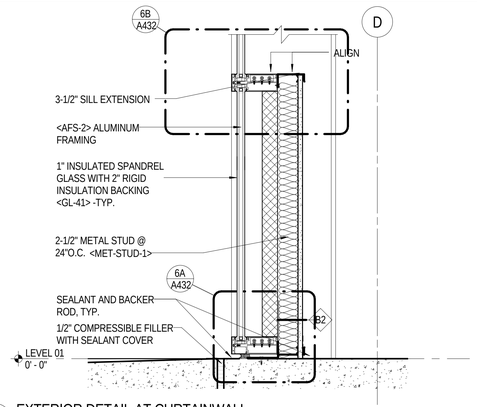


3 EXTERIOR DETAIL AT NORTH "BOX"
1 1/2" = 1'-0"

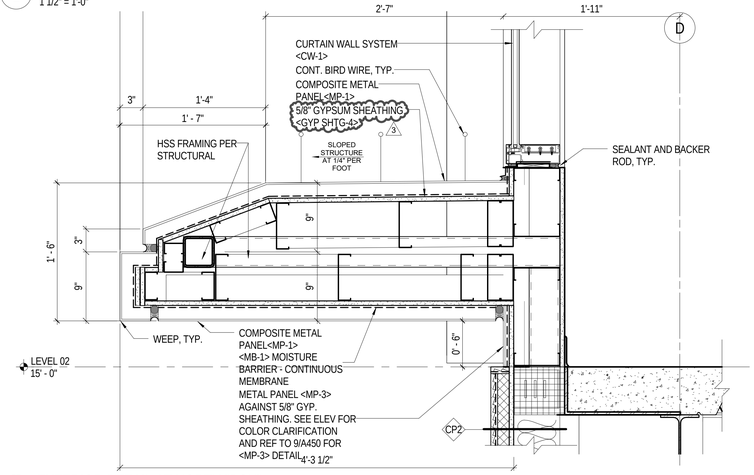
2 EXTERIOR DETAIL AT LEVEL 3 CURTAIN WALL CONNECTION
1 1/2" = 1'-0"



7 LIMESTONE PLASTER TO METAL PANEL INSERT TRANSITION
3" = 1'-0"



4 EXTERIOR DETAIL AT CURTAINWALL
1 1/2" = 1'-0"



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JAMES G. MATSON
No. C13036
REGISTERED ARCHITECT
SEPTEMBER 30, 2019
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
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ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

EXTERIOR SECTION DETAILS

DATE: JULY 06, 2017

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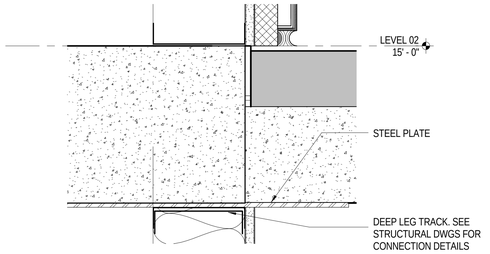
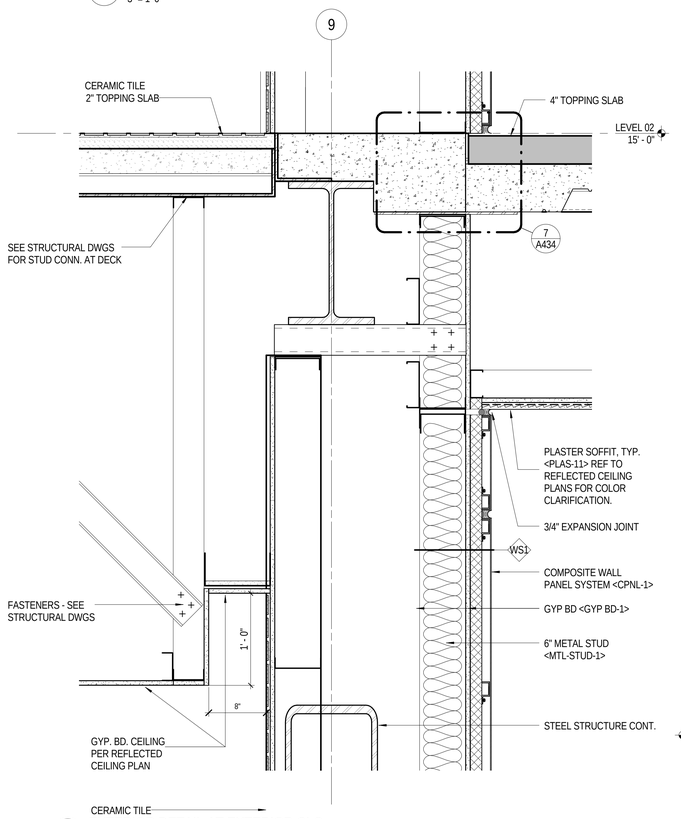
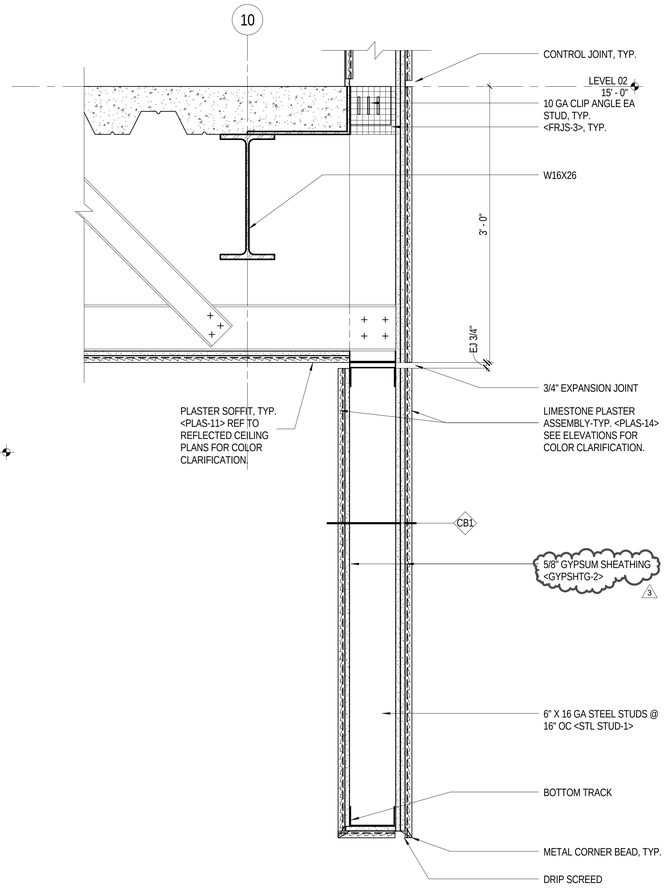


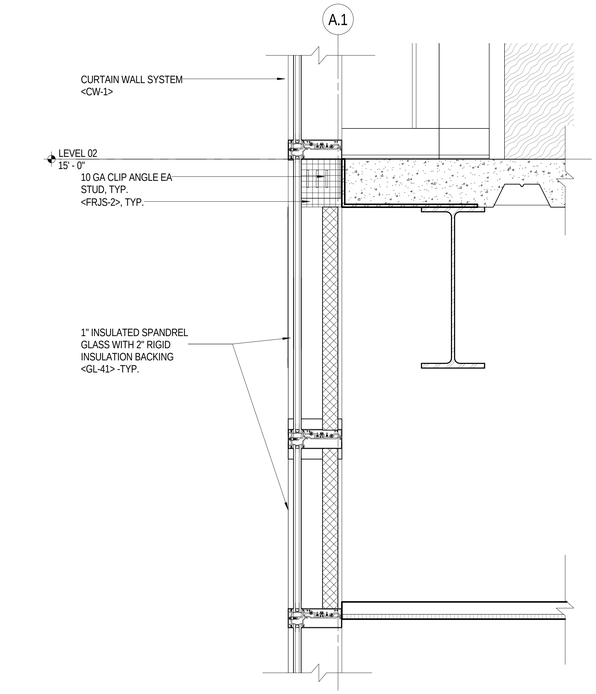
7 ENLARGED DETAIL AT THE TOPPING SLAB TRANSITION
3" = 1'-0"



6 EXTERIOR DETAIL AT EXTERIOR CLG
1 1/2" = 1'-0"



4 EXTERIOR DETAIL AT SLAB
1 1/2" = 1'-0"



2 EXTERIOR DETAIL AT SLAB EDGE
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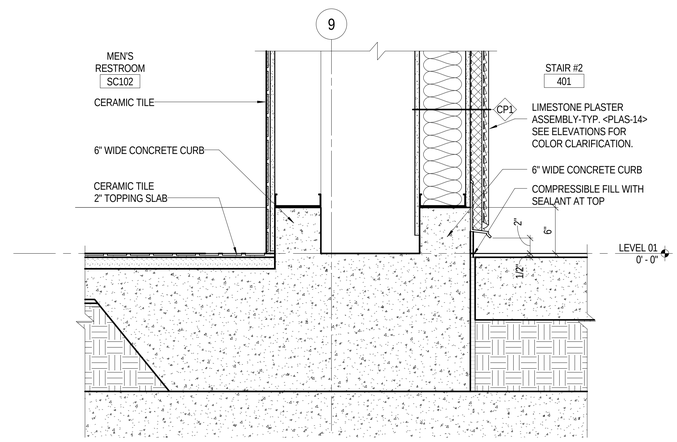
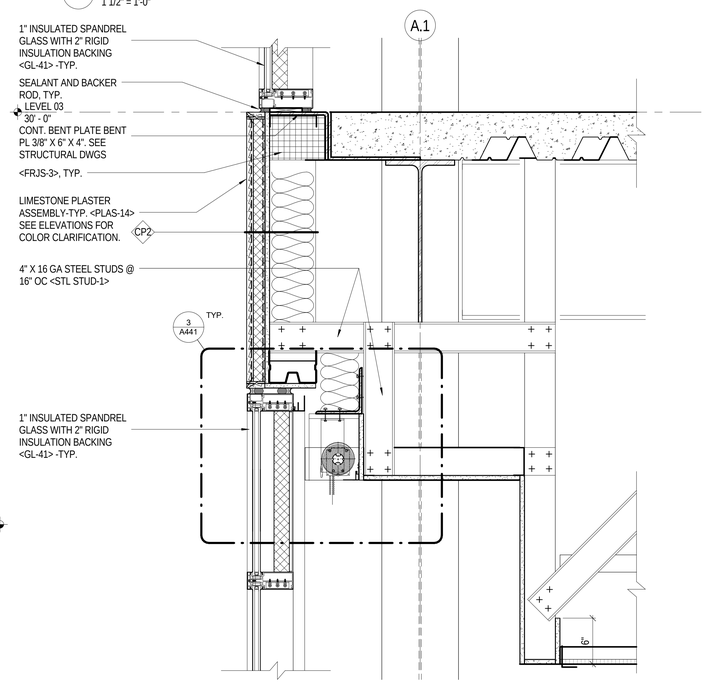
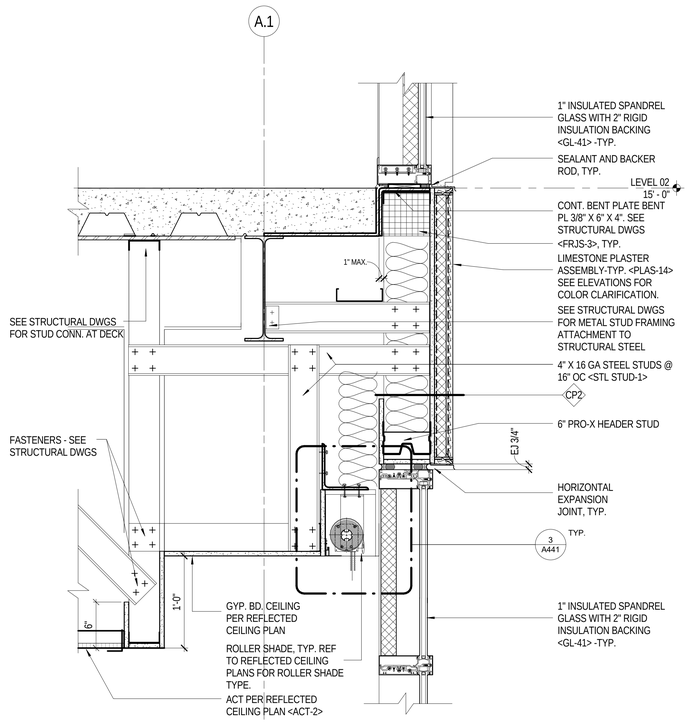


5 EXTERIOR DETAIL AT SLAB
1 1/2" = 1'-0"



3 EXTERIOR DETAIL WINDOW HEAD CONDITION
1 1/2" = 1'-0"



1 EXTERIOR DETAIL AT WINDOW SILL
1 1/2" = 1'-0"

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

EXTERIOR SECTION DETAILS

DATE: JULY 06, 2017

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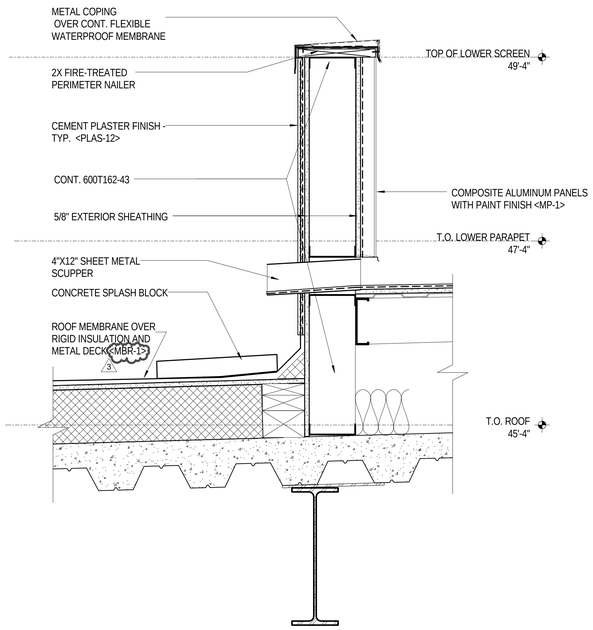
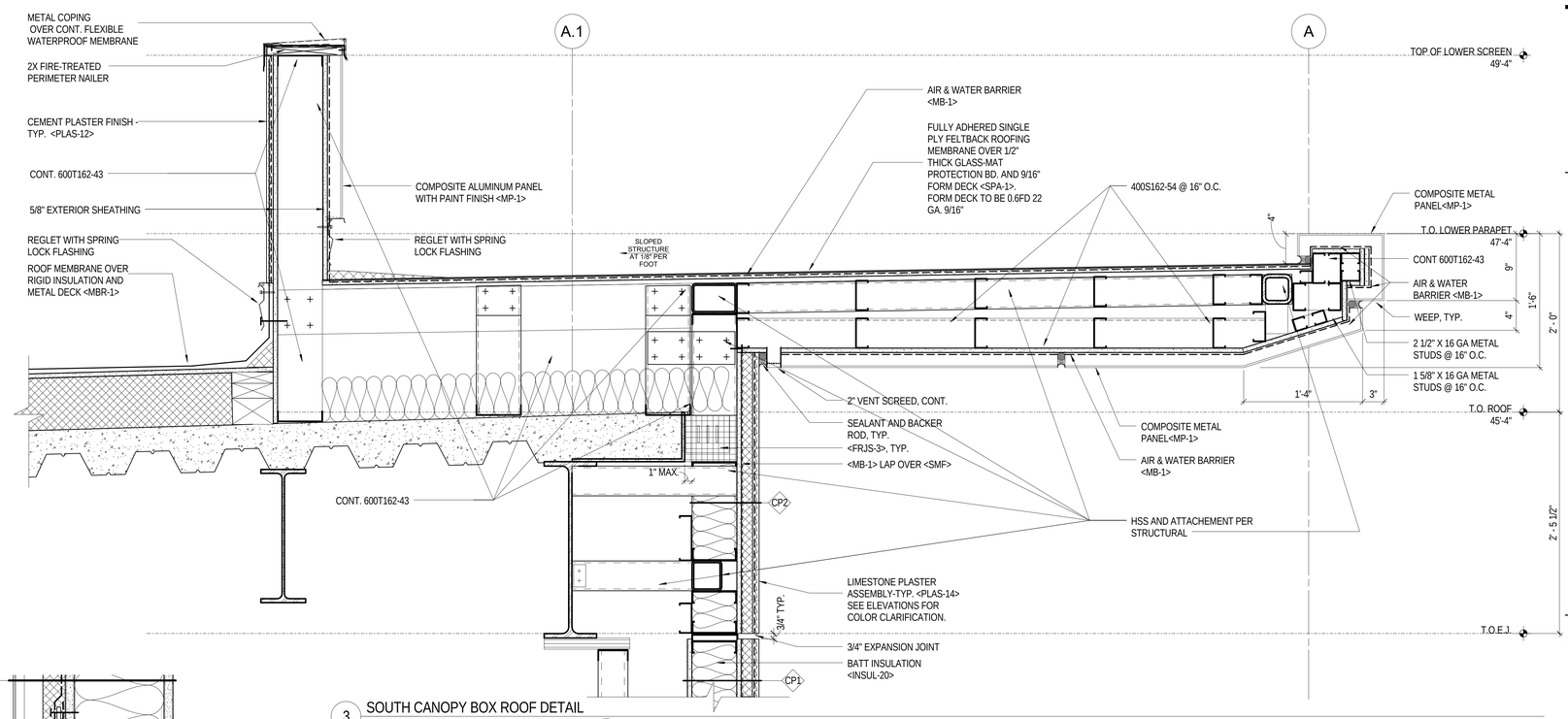
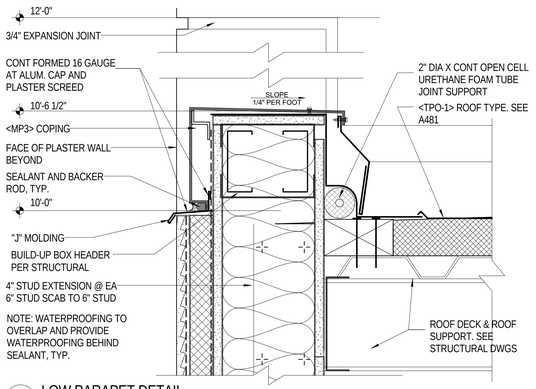


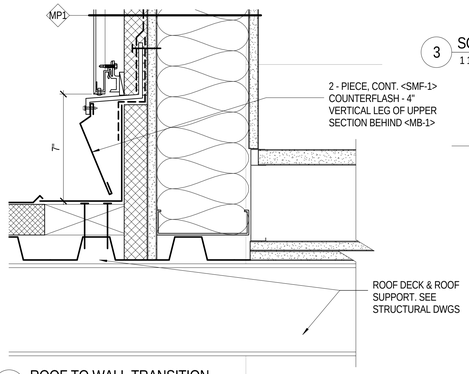
7 SOUTH CANOPY BOX ROOF SCUPPER DETAIL
1 1/2" = 1'-0"



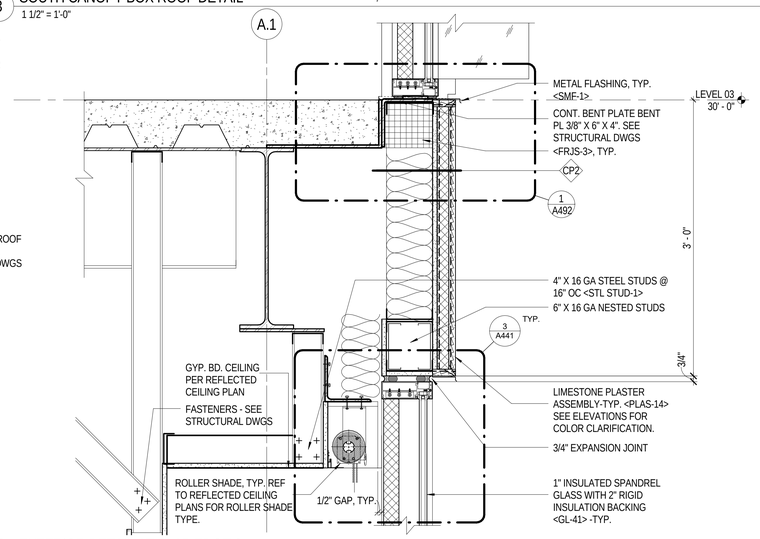
6 LOW PARAPET DETAIL
3" = 1'-0"



5 ROOF TO WALL TRANSITION
3" = 1'-0"

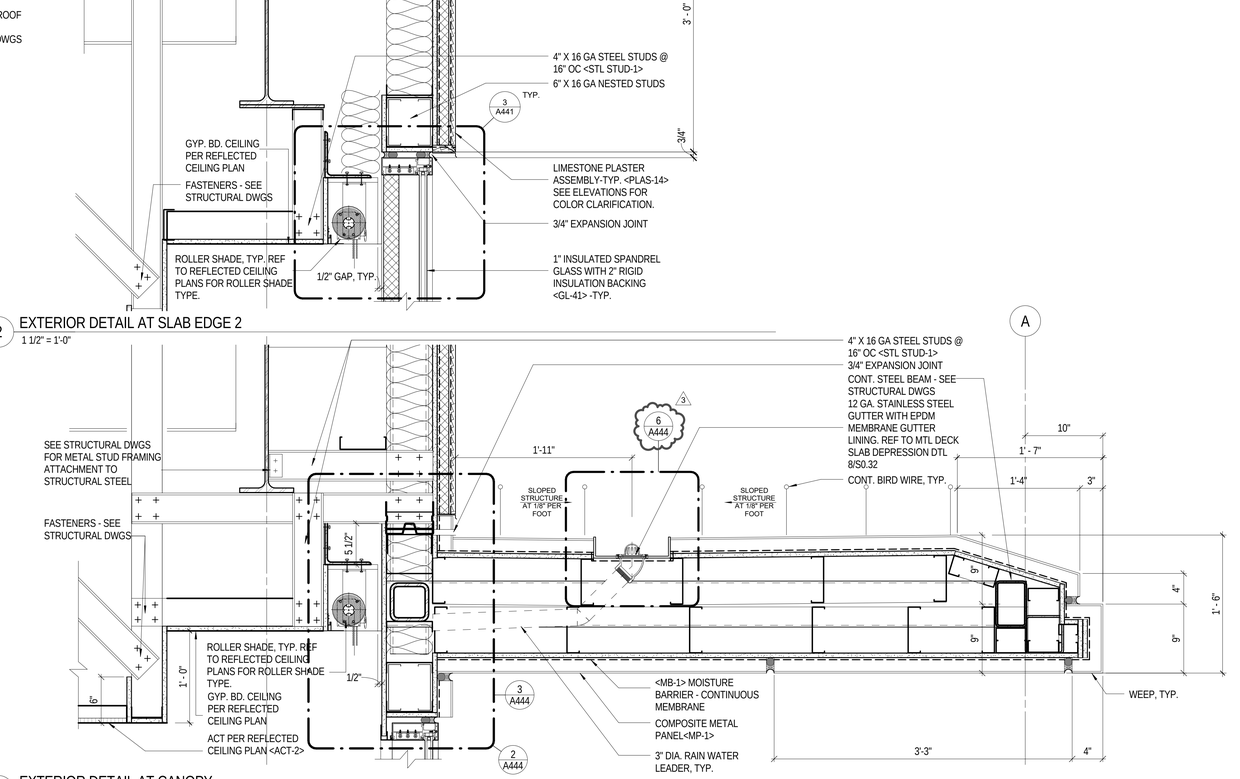


3 SOUTH CANOPY BOX ROOF DETAIL
1 1/2" = 1'-0"



2 EXTERIOR DETAIL AT SLAB EDGE 2
1 1/2" = 1'-0"

4 EXTERIOR DETAIL AT ROOF
1 1/2" = 1'-0"



1 EXTERIOR DETAIL AT CANOPY
1 1/2" = 1'-0"

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LICENSED ARCHITECT
JAMES G. MATSON
No. C-13036
SEPTEMBER 30, 2017
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

EXTERIOR
SECTION
DETAILS

DATE: JULY 06, 2017

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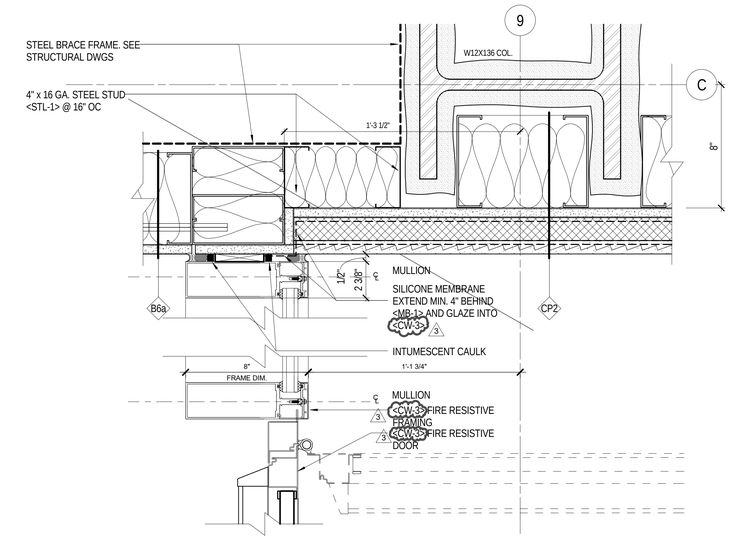
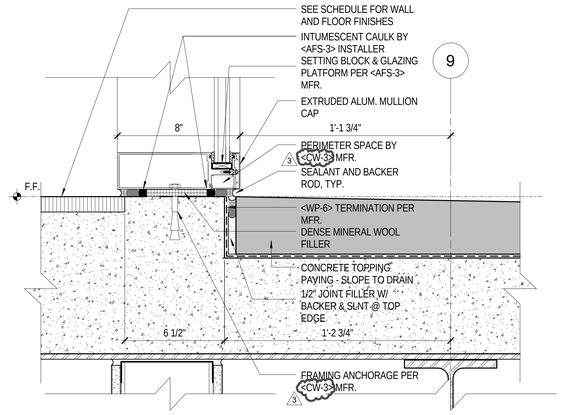
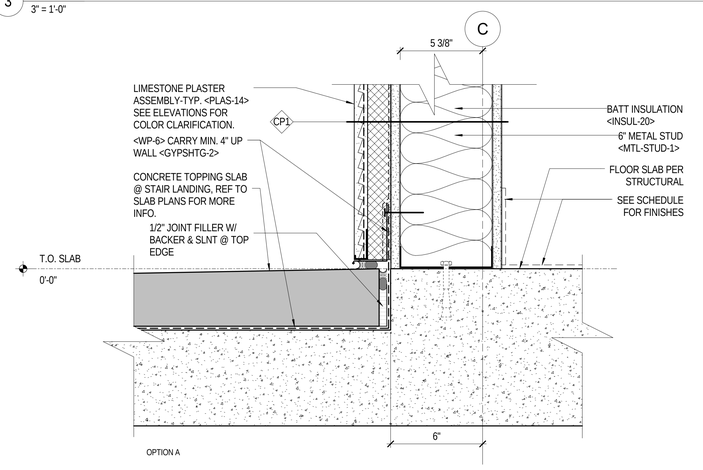


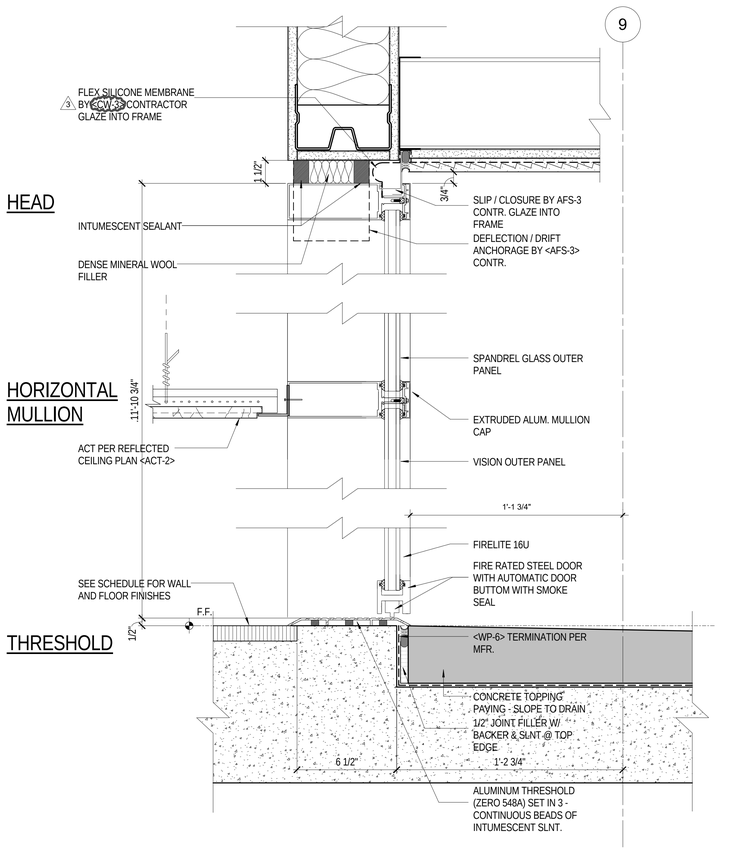
3 DETAILS AT FIRE RESISTIVE EXTERIOR FRAMING AFS-3
3" = 1'-0"



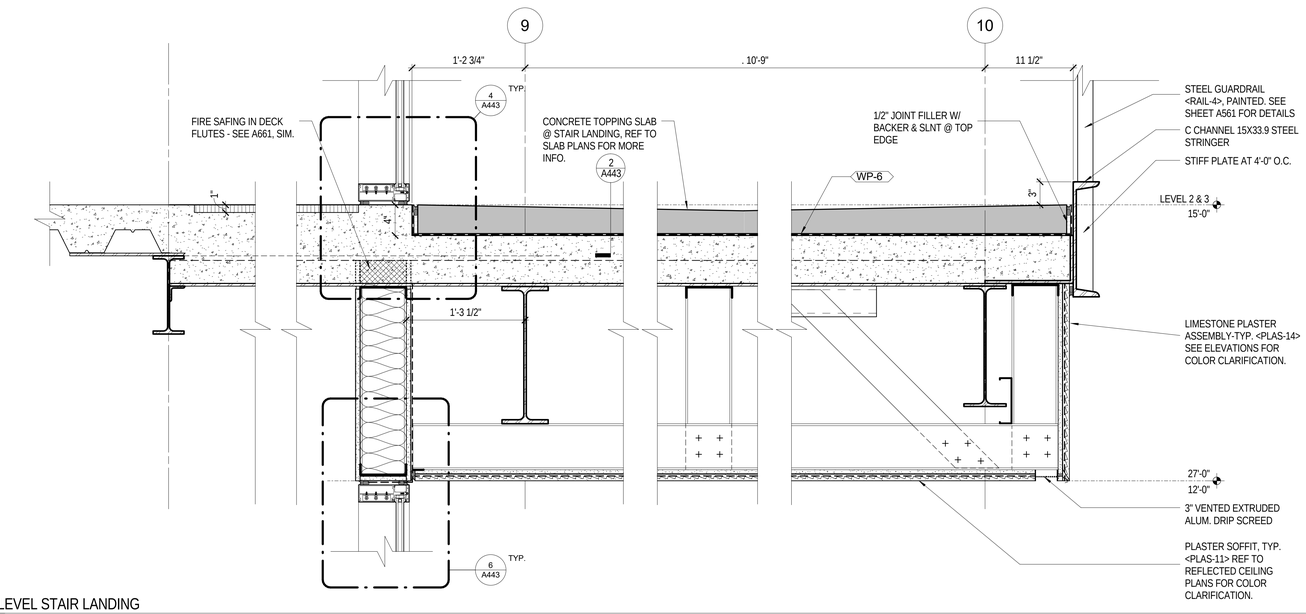
4 DETAIL AT FIRE RESISTIVE EXT. FRAMING
3" = 1'-0"



2 TOPPING SLAB @ STAIR FLOOR LEVEL LANDING
3" = 1'-0"



6 DETAIL AT FIRE RESISTIVE EXTERIOR DOORS
3" = 1'-0"



1 FLOOR LEVEL STAIR LANDING
1 1/2" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON No. C13036 REGISTERED IN THE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

EXTERIOR SECTION DETAILS

DATE: JULY 06, 2017

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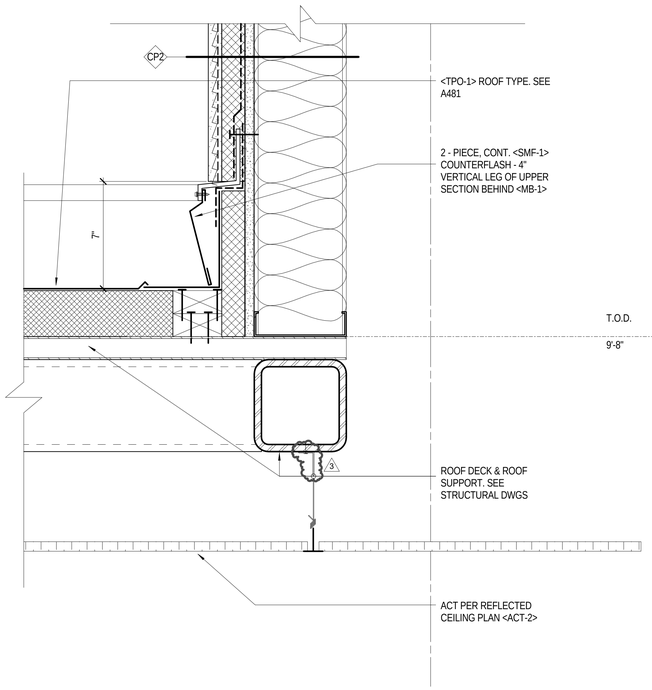
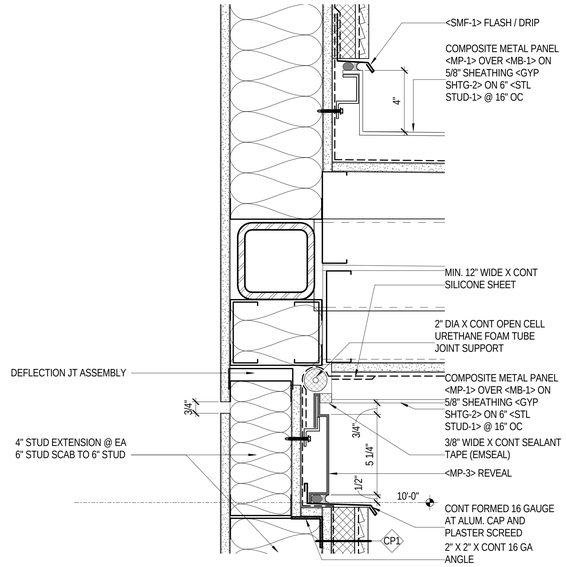
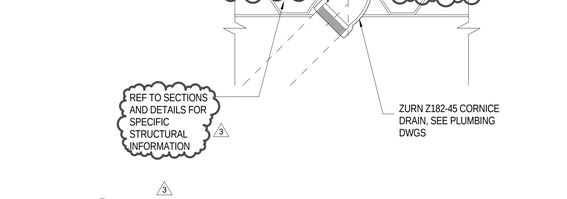


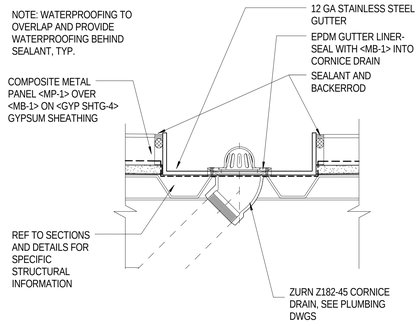
5 ROOF TO WALL TRANSITION
3" = 1'-0"



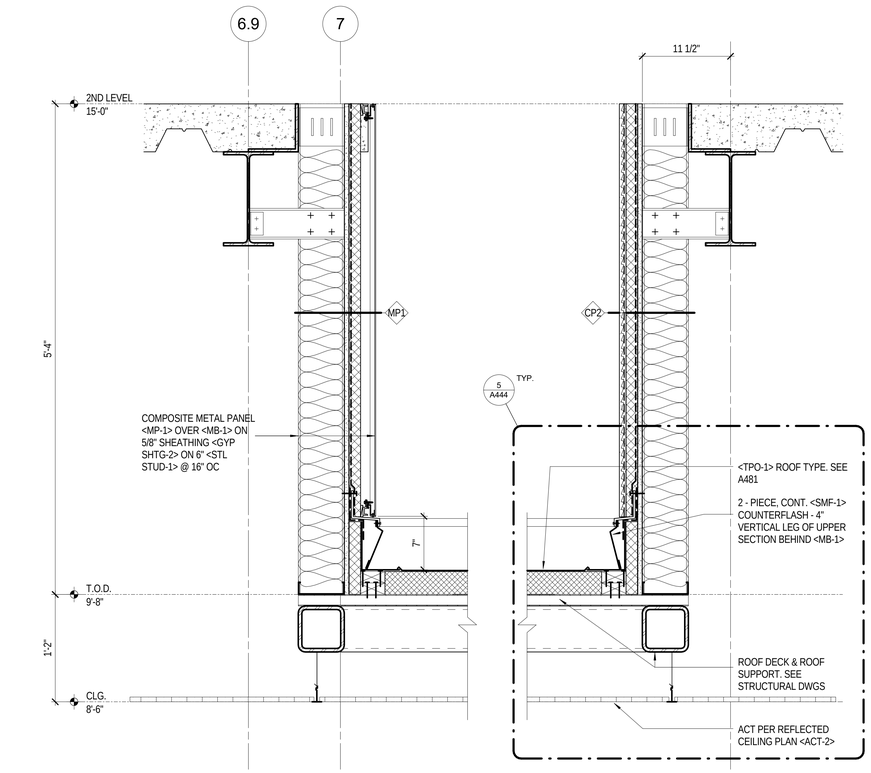
3 REVEAL @ PLASTER WALL
3" = 1'-0"



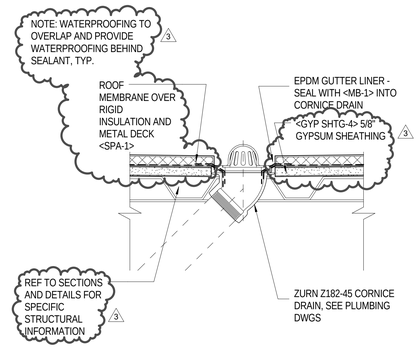
2 HEAD @ TYPE W15 WINDOW
3" = 1'-0"



3
6 GUTTER DRAIN @ METAL PANEL
3" = 1'-0"



4 E-W SECTION, LOOKING NORTH @ ROOF OVER SC116-1
1 1/2" = 1'-0"



3
1 DRAIN @ ENTRY CANOPY
3" = 1'-0"

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JAMES G. MATSON — LICENSED ARCHITECT — REGISTERED PROFESSIONAL ENGINEER — SEPTEMBER 30, 2015 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET
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HGA NO: 3584-001-00

EXTERIOR SECTION DETAILS

DATE: JULY 06, 2017

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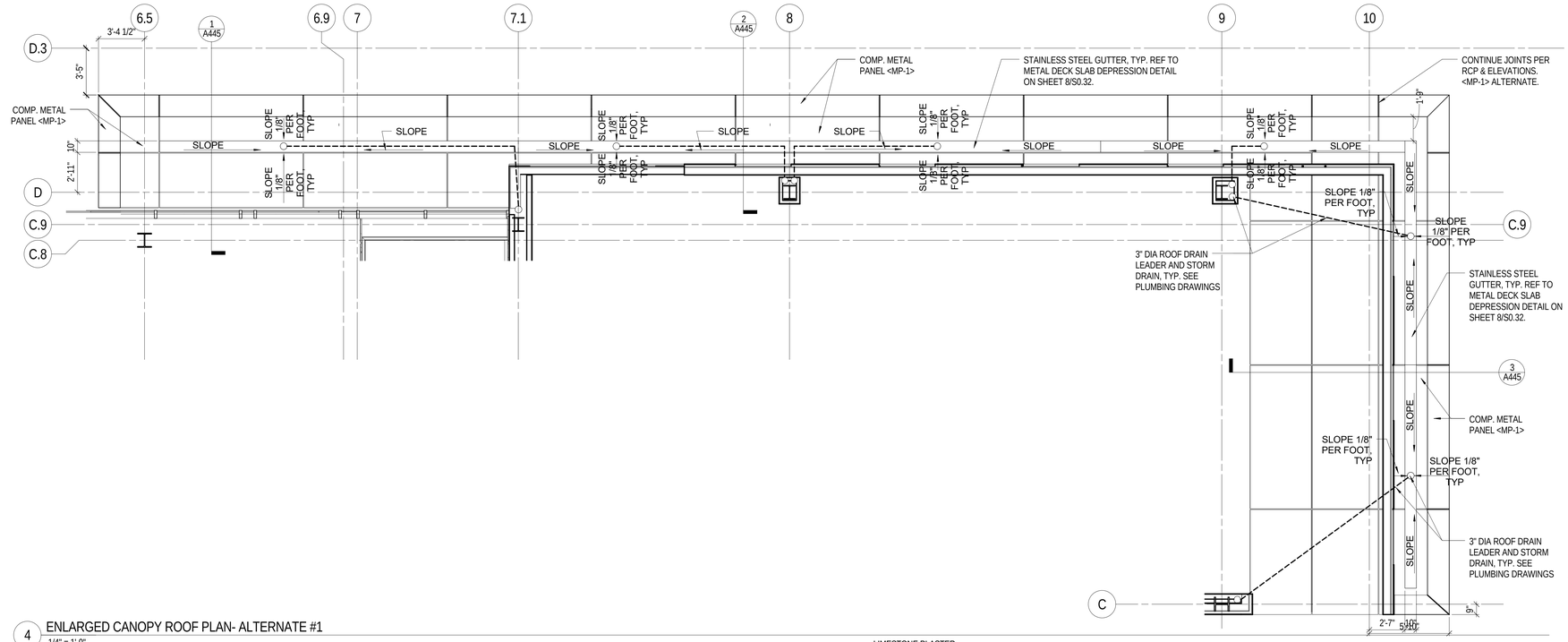
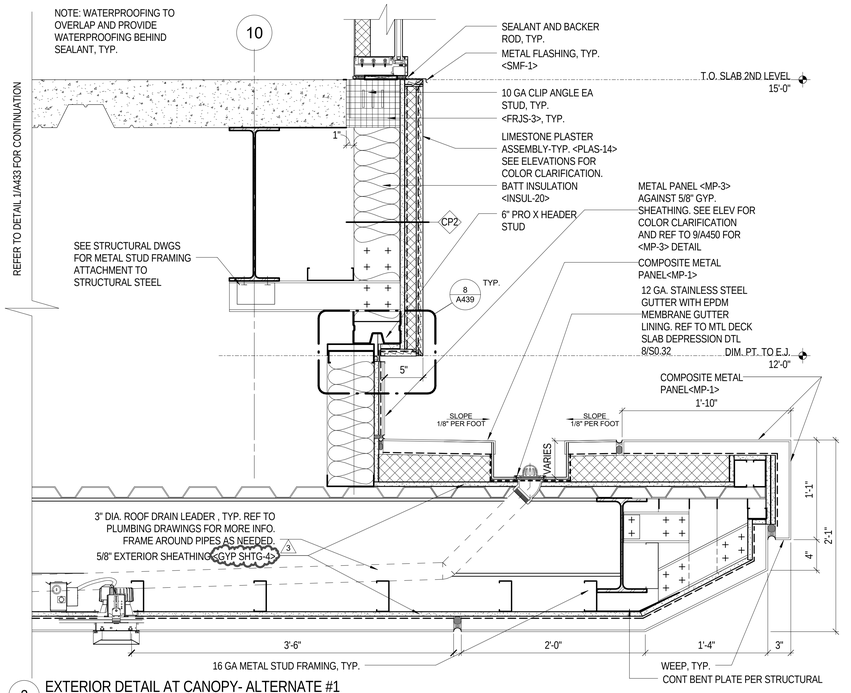


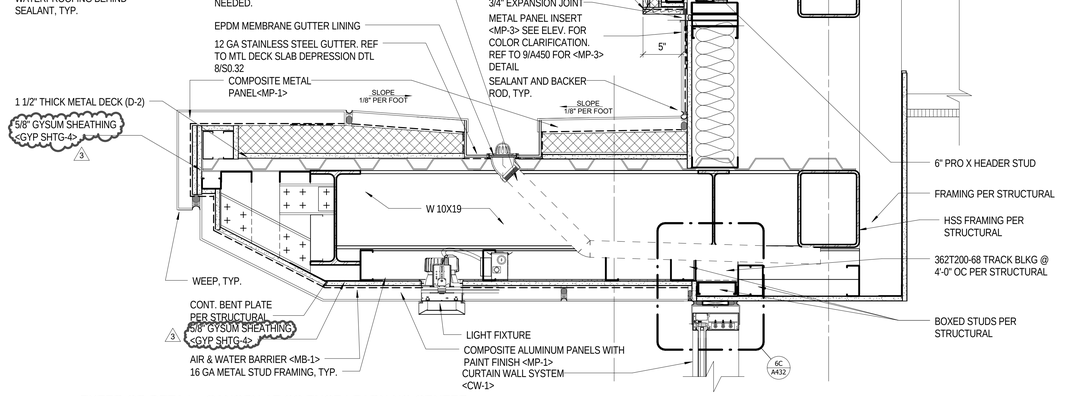
4 ENLARGED CANOPY ROOF PLAN- ALTERNATE #1

1/4" = 1'-0"



3 EXTERIOR DETAIL AT CANOPY- ALTERNATE #1

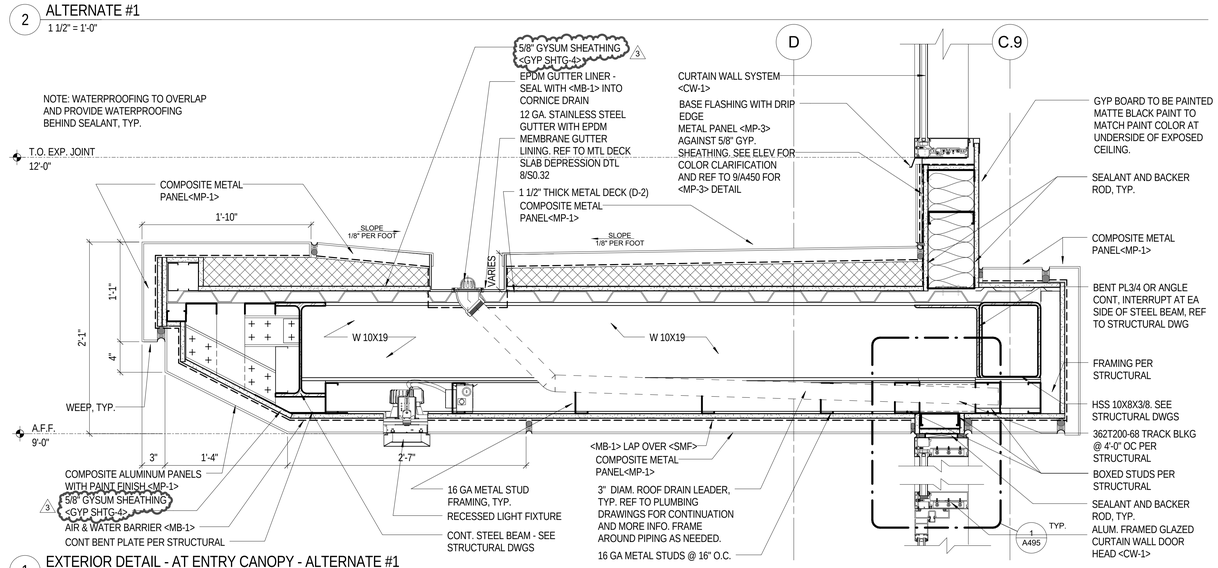
1 1/2" = 1'-0"



EXTERIOR DETAIL - CANOPY AT SCIENCE LEARNING CENTER - ALTERNATE #1

2

1 1/2" = 1'-0"



1 EXTERIOR DETAIL - AT ENTRY CANOPY - ALTERNATE #1

1 1/2" = 1'-0"

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
1	Addendum 1	8/23/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

ALTERNATE #1 - ROOF AT MAIN ENTRANCE CANOPY

DATE: JULY 06, 2017

A445

ADDENDA PACKAGE

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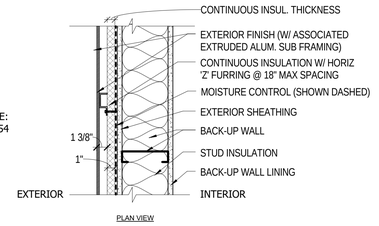
WS SERIES

COMPOSITE **W**ALL PANEL

STEEL **S**TUD
BACK-UP WALL
(CONTINUOUS OUTBOARD
INSULATION AND STUD
INSULATION)

AVAILABLE FIRE RESISTANCE:
1 HOUR: UL DESIGN NO. V454



PLAN VIEW

WALL TYPE	EXTERIOR FINISH			CONT. INSUL.		EXT FIN SHTG	MOIST. CONTRL	BACK-UP WALL		STUD INSUL.		WALL DEPTH	NOTES
	MATERIAL	THK	SUB-FRAME DEPTH	TYPE	THK			STUDS	LINING	TYPE	THK		
WS1	CPNL-1	3/8"	1"	INSUL-15	1"	GYP SHTG-2	MB-1	6" @ 16" OC	GYP BD-1	INSUL-20	6"	10-1/8"	1, 2, 3, 4

NOTE: WALL TYPES NOT REFERENCED ON DRAWINGS MAY NOT BE REQUIRED ON THIS PROJECT.

NOTES:
1. SEE ROOM FINISH SCHEDULE & DRAWINGS FOR INTERIOR WALL LINING VARIATIONS.
2. EXTERIOR FINISH SUPPORT ALUM. EXTRUDED SUB-FRAMING BY EXT. FINISH FABRICATOR.
3. STUD SIZE & SPACING SHOWN IS MIN REQ'D & MUST BE VERIFIED BY DESIGN OF SUPPLIER.
4. TAPE/SEAL ALL JOINTS & PENETRATION @ CONTINUOUS INSULATION.
5. ALL WALL FASTENERS TO BE 24" O.C. MAX AND 2" MIN. FROM EDGE OF PANEL.

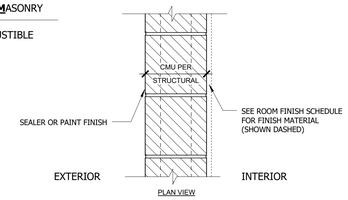
WS#
WALL TYPE SYMBOL

6 EXTERIOR WALL TYPES - COMPOSITE PANEL - WS SERIES
1 1/2" = 1'-0"

M SERIES

CONCRETE **M**ASONRY

NON-COMBUSTIBLE



PLAN VIEW

PTN TYPE	DIMENSIONS		AVAILABLE RESISTANCE		NOTES	AS DRAWN DIMENSION
	ACTUAL	NOMINAL				
M8	7 5/8"	8"	2 HOUR UL DES. NO 618			
M12	11 5/8"	12"	2 HOUR UL DES. NO 618			

NOTE: SOME PARTITION TYPES DESCRIBED ABOVE MAY NOT BE REQUIRED ON THIS PROJECT

NOTES: ALL CONCRETE MASONRY UNITS TO BE 4" IN HEIGHT. WALLS TO BE STACK BOND

M#
WALL TYPE SYMBOL

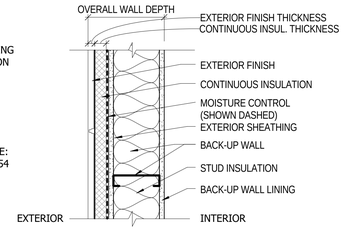
3 EXTERIOR WALL TYPES - CONCRETE MASONRY UNIT - M SERIES
1 1/2" = 1'-0"

MS SERIES

FORMED **M**ETAL PANEL **S**IDING
- HORIZONTAL INSTALLATION

STEEL STUD
BACK-UP WALL
(CONTINUOUS OUTBOARD
INSULATION AND STUD
INSULATION)

AVAILABLE FIRE RESISTANCE:
1 HOUR: UL DESIGN NO. V454



PLAN VIEW

WALL TYPE	EXTERIOR FINISH		CONT. INSUL.		EXT FIN SHTG	MOIST. CONTRL	BACK-UP WALL		STUD INSUL.		WALL DEPTH	NOTES
	MATERIAL	THK	TYPE	THK			STUDS	LINING	TYPE	THK		
MS1	MP-2	1"	INSUL-15	1-1/2"	GYP SHTG-2	MB-1	6" @ 16" OC	GYP BD-1	INSUL-20	6"	9-1/4"	1, 2, 3

NOTE: WALL TYPES NOT REFERENCED ON DRAWINGS MAY NOT BE REQUIRED ON THIS PROJECT.

NOTES:
1. SEE ROOM FINISH SCHEDULE & DRAWINGS FOR INTERIOR WALL LINING VARIATIONS.
2. STUD SIZE & SPACING SHOWN IS MIN REQ'D & MUST BE VERIFIED BY DESIGN OF SUPPLIER.
3. TAPE/SEAL ALL JOINTS & PENETRATION @ CONTINUOUS INSULATION.

MS#
WALL TYPE SYMBOL

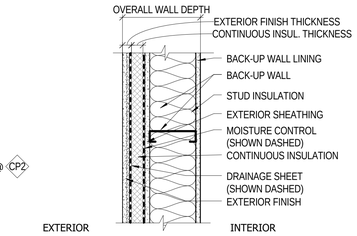
5 EXTERIOR WALL TYPES - METAL PANEL - MS SERIES
1 1/2" = 1'-0"

CP SERIES

CEMENT **P**LASTER
(STUCCO VENEER)

STEEL STUD
BACK-UP WALL
(CONTINUOUS
OUTBOARD INSULATION
AND STUD INSULATION)

AVAILABLE FIRE RESISTANCE
1 HOUR: UL DESIGN NO: V454 @ CP2



PLAN VIEW

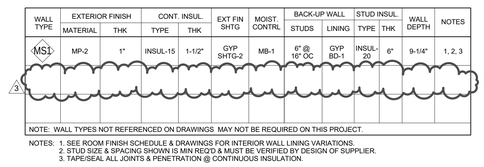
WALL TYPE	EXTERIOR FINISH			DRAIN SHEET	CONT. INSUL.		EXT FIN SHTG	MOIST CONTRL	BACK-UP WALL		STUD INSUL.		WALL WIDTH	NOTES
	MATERIAL	LATH	THK		TYPE	THK			STUDS	LINING	TYPE	THK		
CP1	PLAS-14	SELF-FURR	7/8"	1-LAYER AF-1	INSUL-15	1-1/2"	GYP SHTG-2	MB-1	6" @ 16" OC	GYP BD-1	INSUL-20	6"	9-5/8"	1, 2, 3
CP2	PLAS-14	SELF-FURR	7/8"	1-LAYER AF-1	INSUL-15	1-1/2"	GYP SHTG-2	MB-1	6" @ 16" OC	NONE	INSUL-20	6"	9"	2, 3

NOTE: WALL TYPES NOT REFERENCED ON DRAWINGS MAY NOT BE REQUIRED ON THIS PROJECT.

NOTES:
1. SEE ROOM FINISH SCHEDULE & DWGS FOR INTERIOR WALL LINING VARIATIONS.
2. ATTACH LATH OVER DRAINAGE SHEET THRU CONTINUOUS INSULATION TO STUDS BEHIND.
3. STUD SIZES & SPACING SHOWN IS MIN REQ'D & MUST BE VERIFIED BY DESIGN OF SUPPLIER.

CP#
WALL TYPE SYMBOL

2 EXTERIOR WALL TYPE - CP SERIES
1 1/2" = 1'-0"



NOTE: ALL HORIZONTAL JOINT FOR METAL PANEL SYSTEM TO RECEIVE FLAT PLATE 6"x14 GA BACKING AS PER G/S0.50. VERTICAL JOINT MUST BE ALIGNED WITH THE METAL STUD.

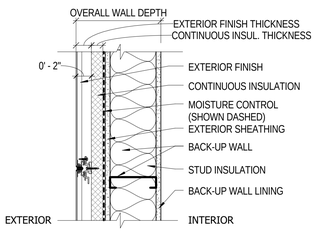
9 TYPICAL METAL PANEL DETAIL <MP-3>
3" = 1'-0"

MP SERIES

COMPOSITE FORMED **M**ETAL **P**ANEL

STEEL STUD
BACK-UP WALL
(CONTINUOUS OUTBOARD
INSULATION AND STUD
INSULATION)

AVAILABLE FIRE RESISTANCE:
1 HOUR: UL DESIGN NO. V454



PLAN VIEW

REFER TO DETAIL 8/A450 FOR TYPICAL METAL PANEL DETAIL.

WALL TYPE	EXTERIOR FINISH		CONT. INSUL.		EXT FIN SHTG	MOIST. CONTRL	BACK-UP WALL		STUD INSUL.		WALL DEPTH	NOTES
	MATERIAL	THK	TYPE	THK			STUDS	LINING	TYPE	THK		
MP1	MP-1	2" TO 2-1/4"	INSUL-15	1-1/2"	GYP SHTG-2	MB-1	6" @ 16" OC	GYP BD-1	INSUL-20	6"	10-3/4" TO 11"	1, 2, 3, 4

NOTE: WALL TYPES NOT REFERENCED ON DRAWINGS MAY NOT BE REQUIRED ON THIS PROJECT.

NOTES:
1. SEE ROOM FINISH SCHEDULE & DRAWINGS FOR INTERIOR WALL LINING VARIATIONS.
2. EXTERIOR FINISH SUPPORT EXTRUSIONS/RIVETS/SCREWS/FURR CHANNELS/SHIMS BY EXTERIOR FINISH FABRICATOR.
3. STUD SIZE & SPACING SHOWN IS MIN REQ'D & MUST BE VERIFIED BY DESIGN OF SUPPLIER.
4. TAPE/SEAL ALL JOINTS & PENETRATION @ CONTINUOUS INSULATION.

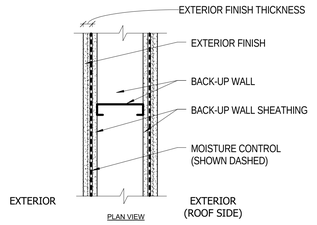
MP#
WALL TYPE SYMBOL

4. EXTERIOR WALL TYPES - METAL PANEL - MP SERIES
1 1/2" = 1'-0"

CB SERIES

CEMENT PLASTER
(STUCCO VENEER
ON **B**OTH SIDES)

STEEL STUD
BACK-UP WALL
(NO INSULATION)



PLAN VIEW

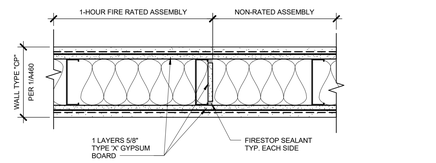
WALL TYPE	EXTERIOR FINISH			MOISTURE CONTROL	BACK-UP WALL		WALL DEPTH	NOTES
	MATERIAL	LATH	THK		SHTG	STUDS		
CB1	PLAS-14	SELF-FURR	7/8"	2 LAYERS AF-1	GYP SHTG-2	6" @ 16" OC	9"	1, 2
CB2	PLAS-14 PLAS-12	SELF-FURR	7/8"	2 LAYERS AF-1	GYP SHTG-2	6" @ 16" OC	9"	1, 3

NOTE: WALL TYPES NOT REFERENCED ON DRAWINGS MAY NOT BE REQUIRED ON THIS PROJECT.

NOTES:
1. STUD SIZE & SPACING SHOWN IS MIN. REQUIRE & MUST BE VERIFIED BY DESIGN OF SUPPLIER.
2. STUCCO VENEER <PLAS-14> APPLIED TO BOTH SIDES OF STUD.
3. STUCCO VENEER <PLAS-12> APPLIED TO ROOF SIDE OF WALL.

CB#
WALL TYPE SYMBOL

1 EXTERIOR WALL TYPES - CB SERIES
1 1/2" = 1'-0"



7 1-HOUR TERMINATION AT "CP" SERIES
1 1/2" = 1'-0"

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SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON — No. C13036 — REGISTERED ARCHITECT — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

EXTERIOR WALL TYPES, NOTES AND TYPICAL DETAILS

DATE: JULY 06, 2017

A450

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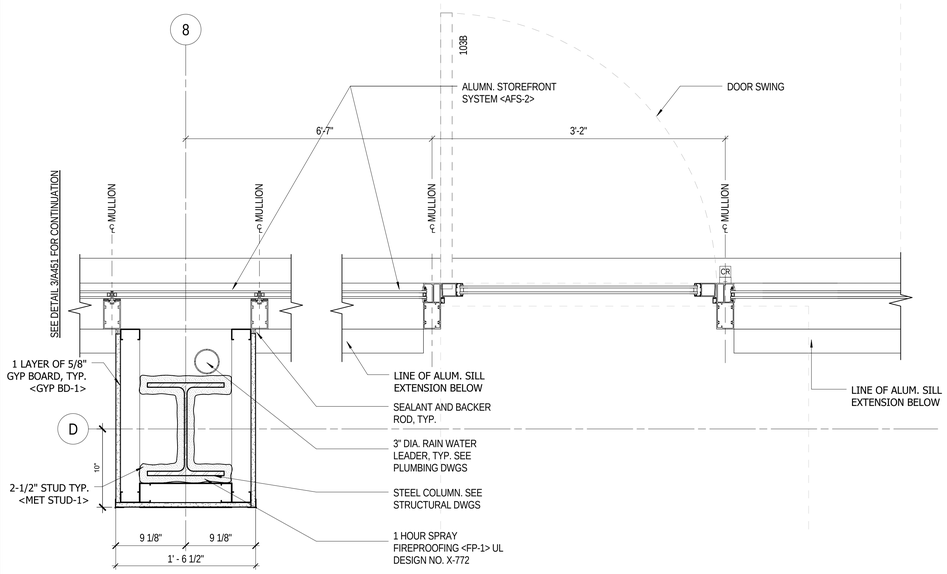
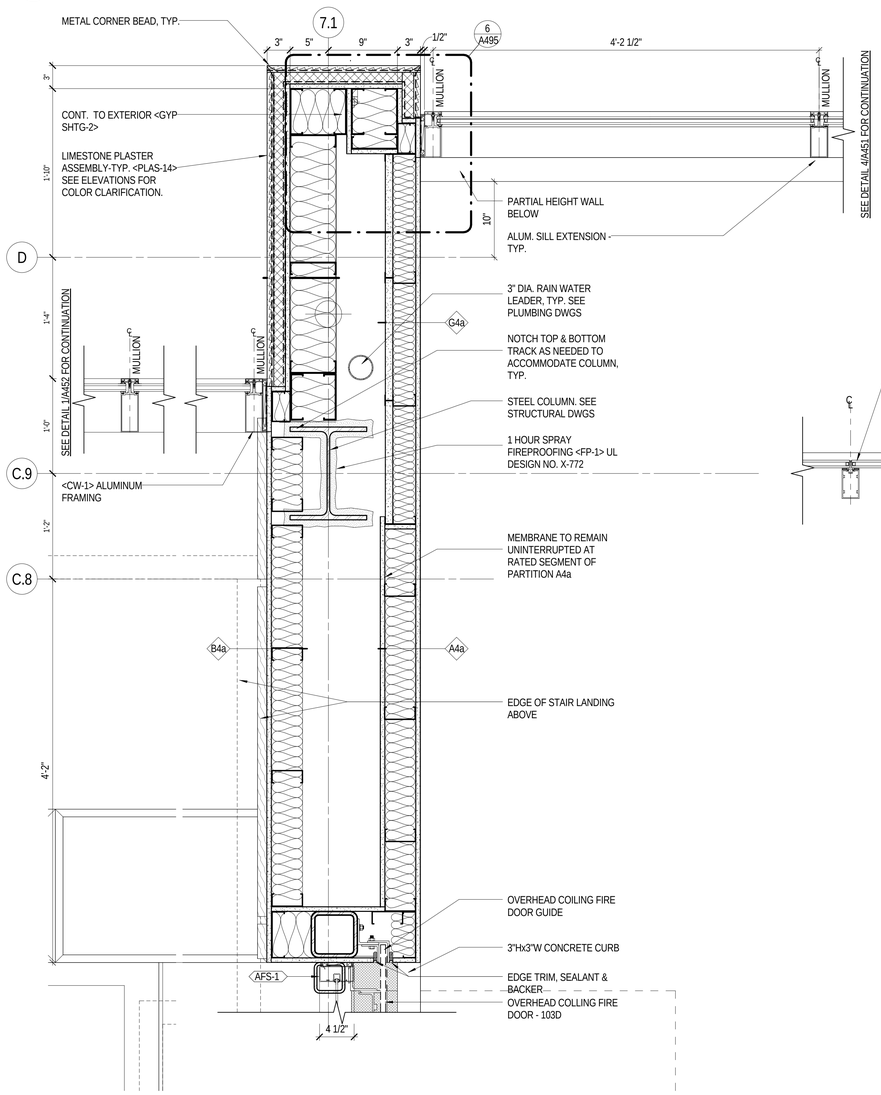
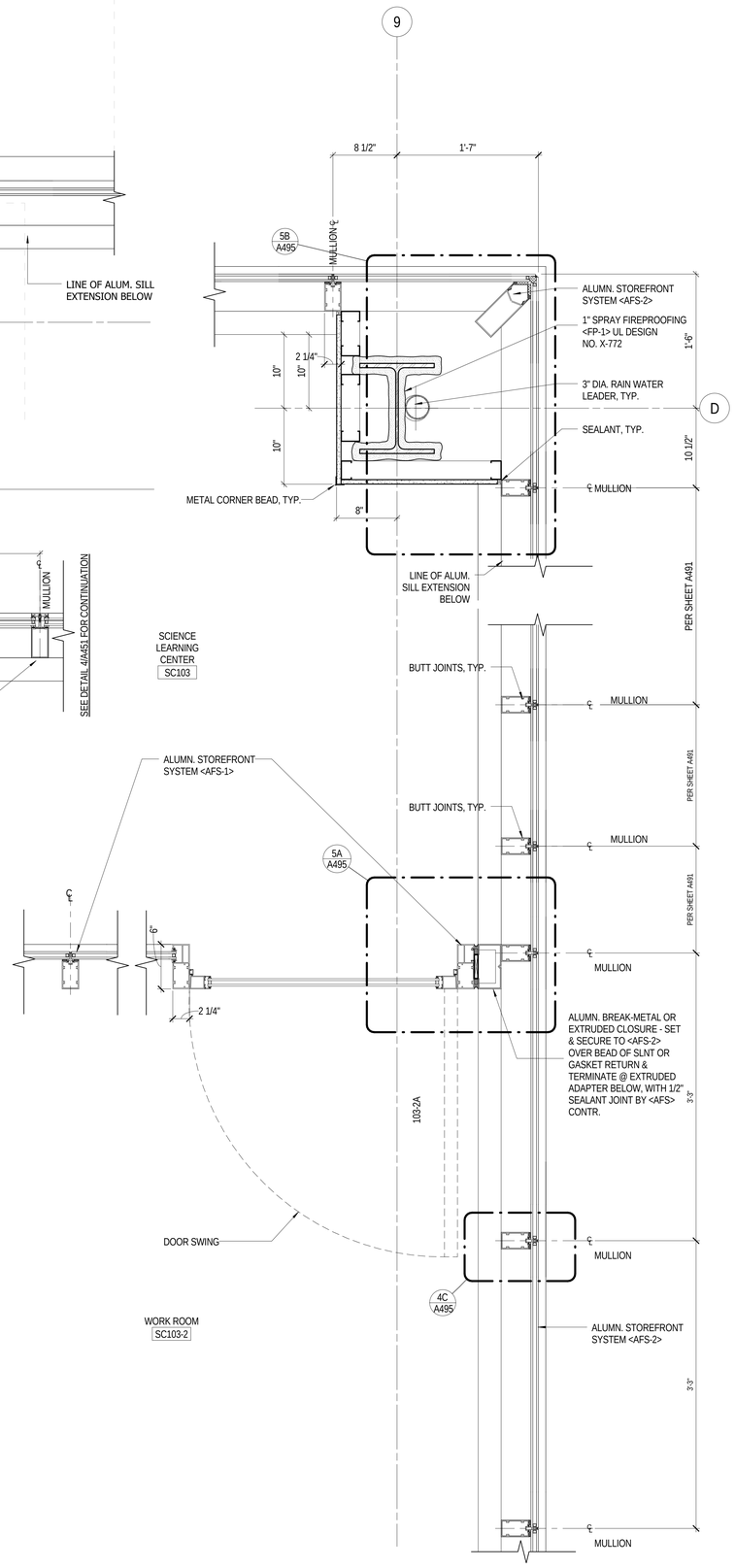


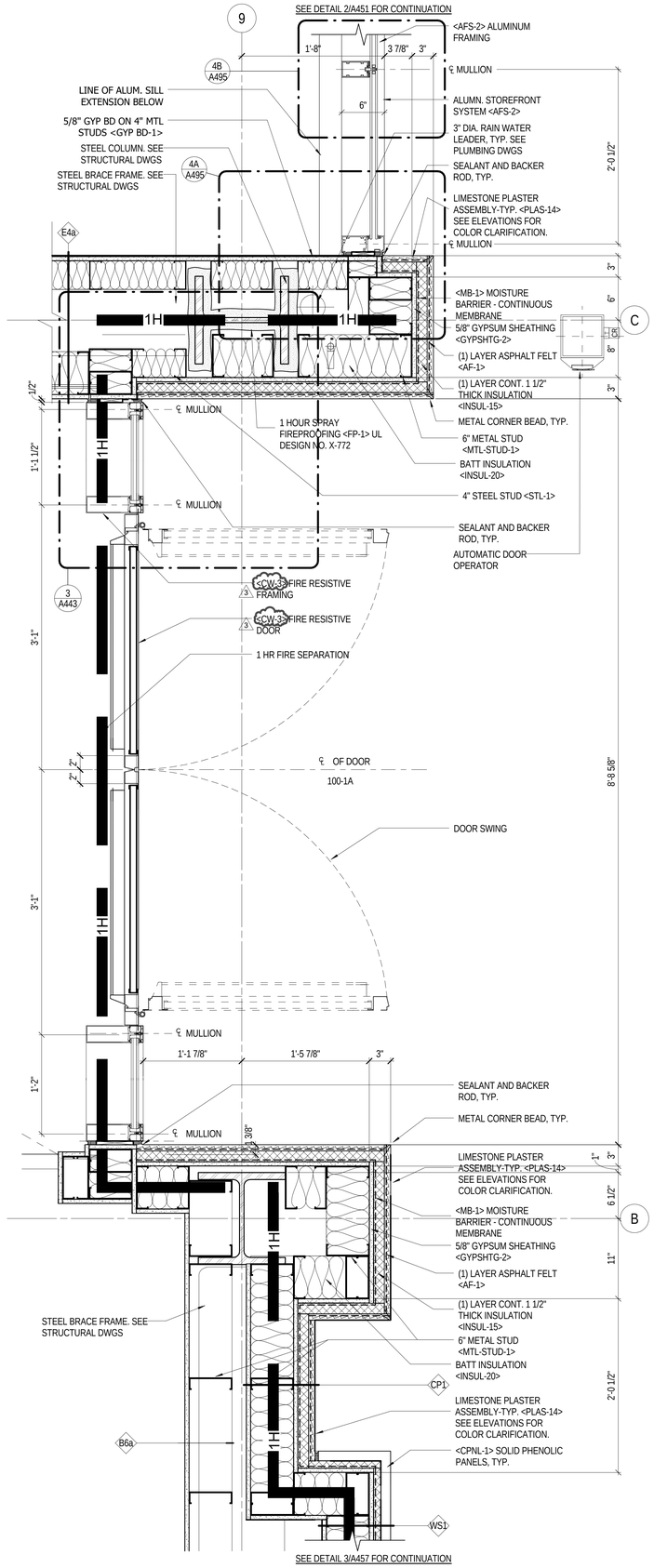
4 COLUMN PLAN DETAIL @ GRID D & 8 - FIRST FLOOR
1 1/2" = 1'-0"



3 COLUMN PLAN DETAIL @ GRID C.1 & 7.1 - FIRST FLOOR
1 1/2" = 1'-0"



2 COLUMN PLAN DETAIL AT GRID C & 9, D & 9 - FIRST FLOOR
1 1/2" = 1'-0"



1 COLUMN PLAN DETAIL @ GRID C & 1.1 - FIRST FLOOR
1 1/2" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON No. C13036 REGISTERED PROFESSIONAL ENGINEER
SEPTEMBER 30, 2019 RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
1	Addendum 1	8/23/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

EXTERIOR PLAN DETAILS - FIRST FLOOR

DATE: JULY 06, 2017

A451 ADDENDA PACKAGE

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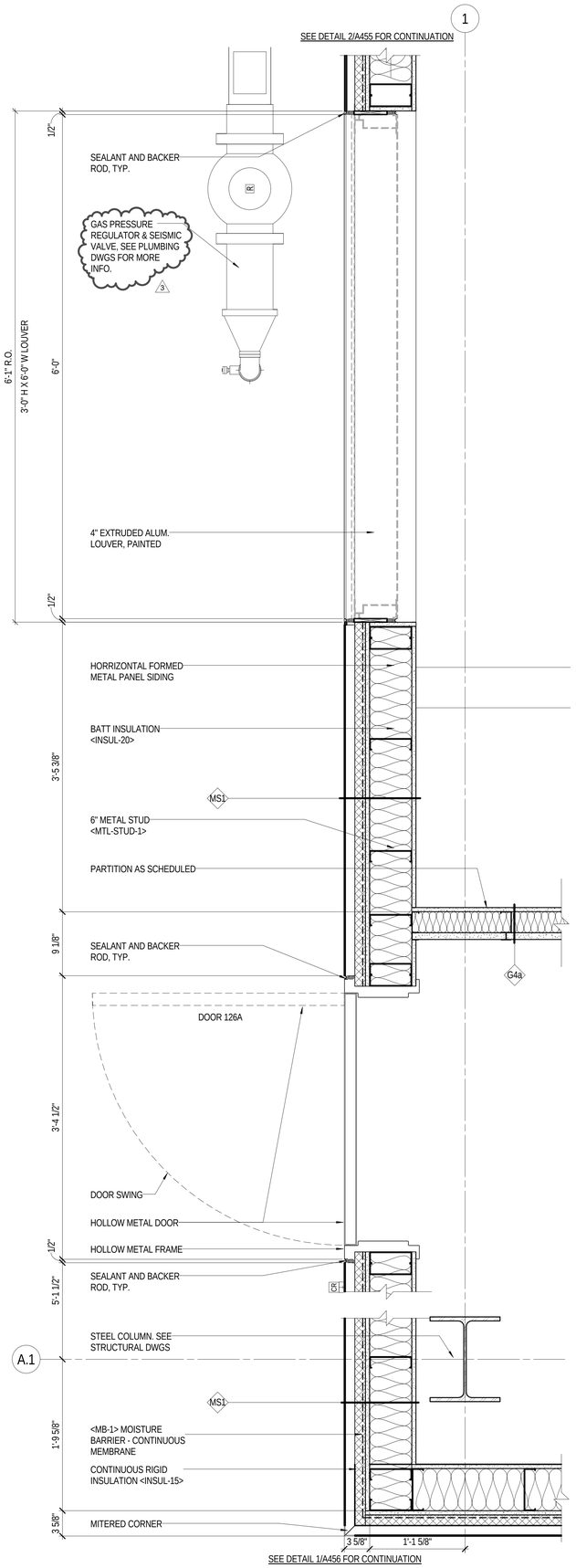
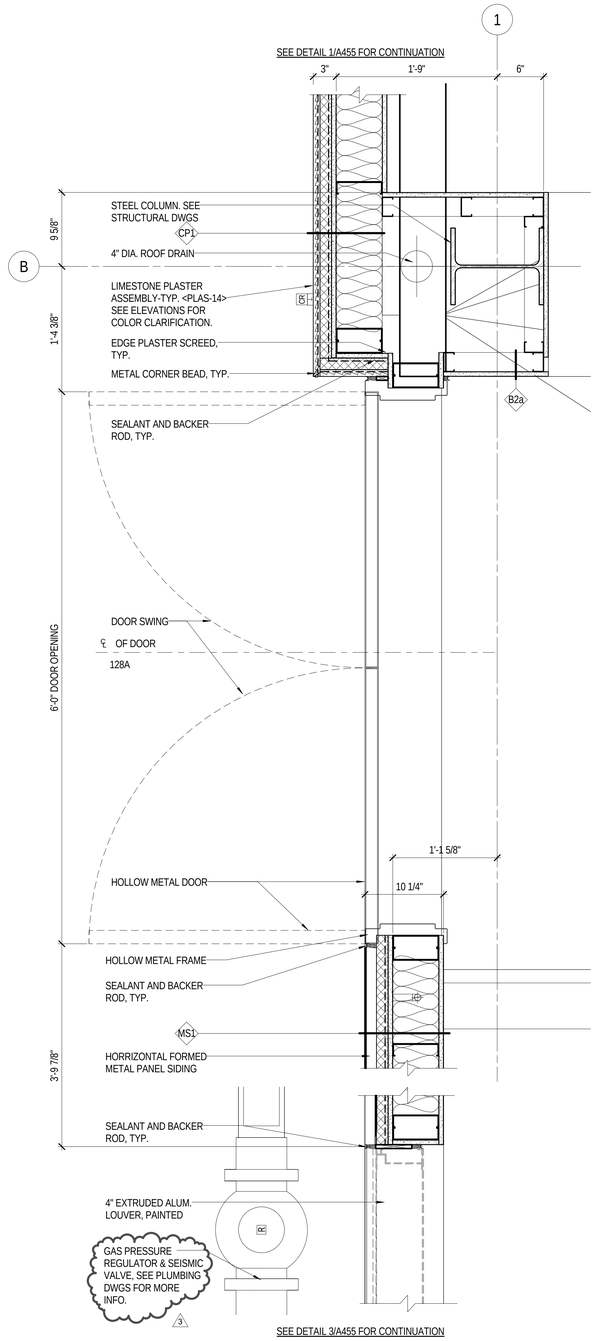
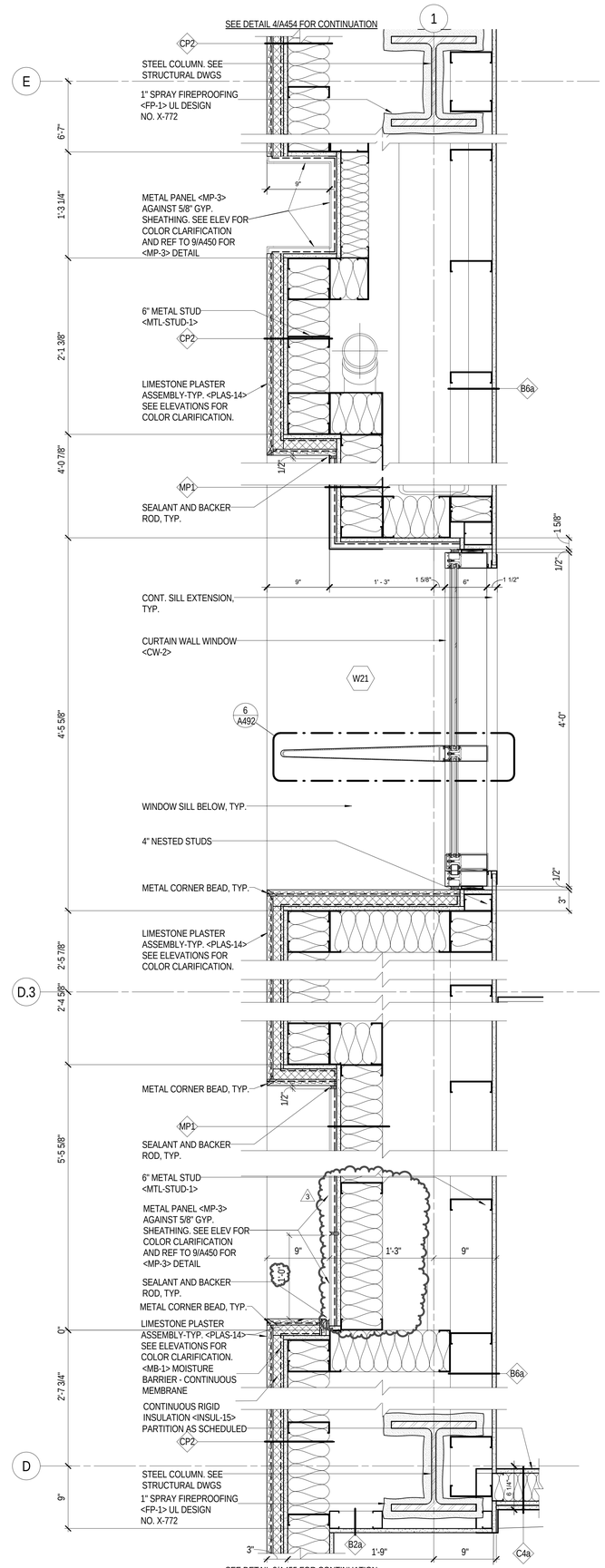


3 COLUMN PLAN DETAIL @ GRID A.1 & 1 - FIRST FLOOR
1 1/2" = 1'-0"



2 COLUMN PLAN DETAIL @ GRID B & 1 - FIRST FLOOR
1 1/2" = 1'-0"



1 WINDOW PLAN DETAIL, WEST WALL @ GRID D - FIRST FLOOR
1 1/2" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON No. C-13036 RENEWAL DATE SEPTEMBER 30, 2019 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C-13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

EXTERIOR PLAN DETAILS - FIRST FLOOR

DATE: JULY 06, 2017

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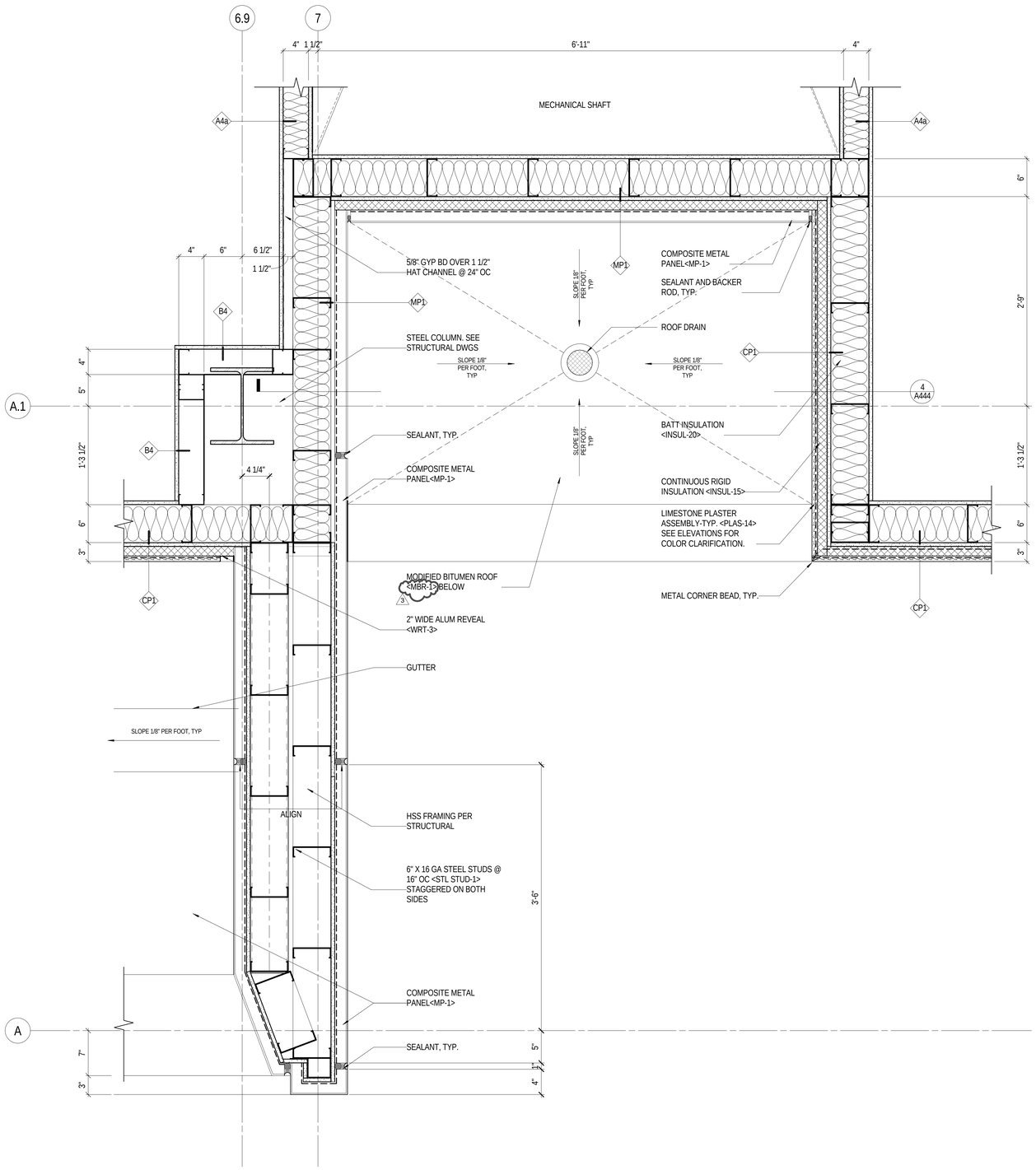
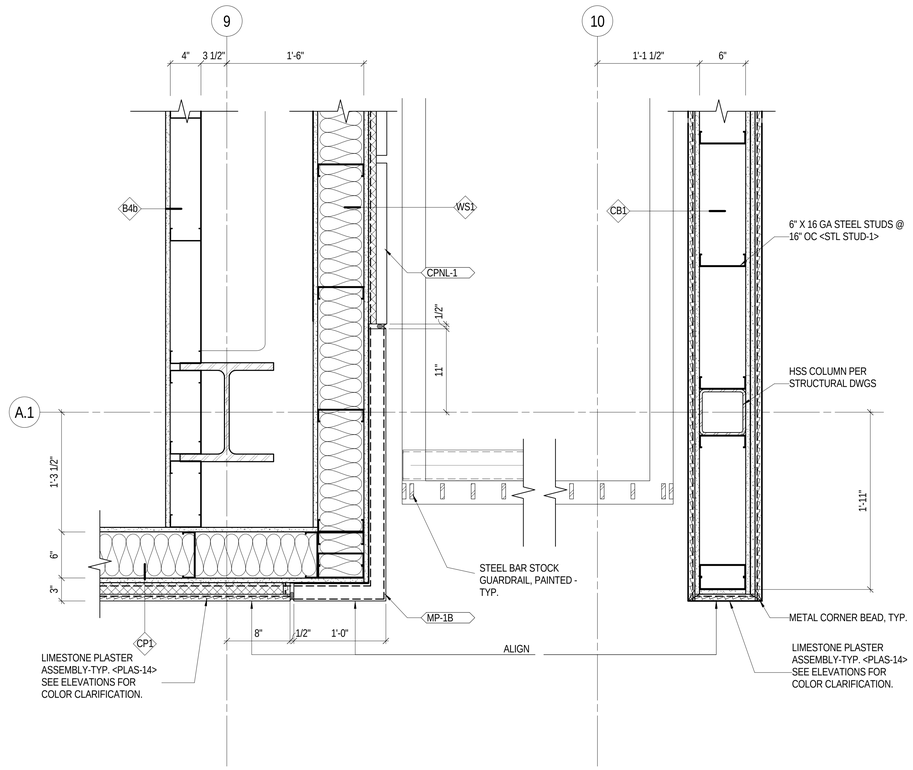


1 SHROUD PLAN DETAIL AT SOUTH FACADE - SECOND FLOOR
1 1/2" = 1'-0"



2 COLUMN PLAN DETAIL AT GRID 9 & A.1 - SECOND FLOOR
1 1/2" = 1'-0"

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JAMES G. MATSON — LICENSED ARCHITECT — EXPIRATION 08-31-2017 — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

EXTERIOR PLAN DETAILS - SECOND AND THIRD FLOOR

DATE: JULY 06, 2017

A464

DSA APPROVAL SET

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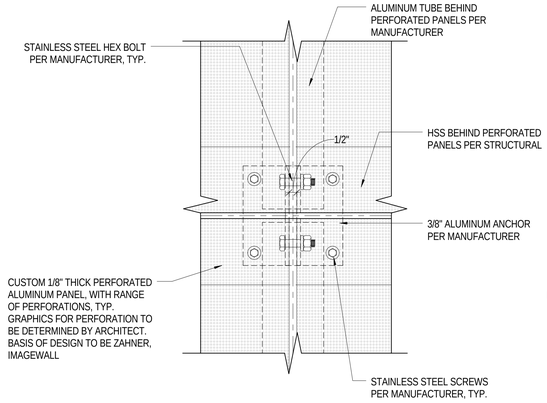
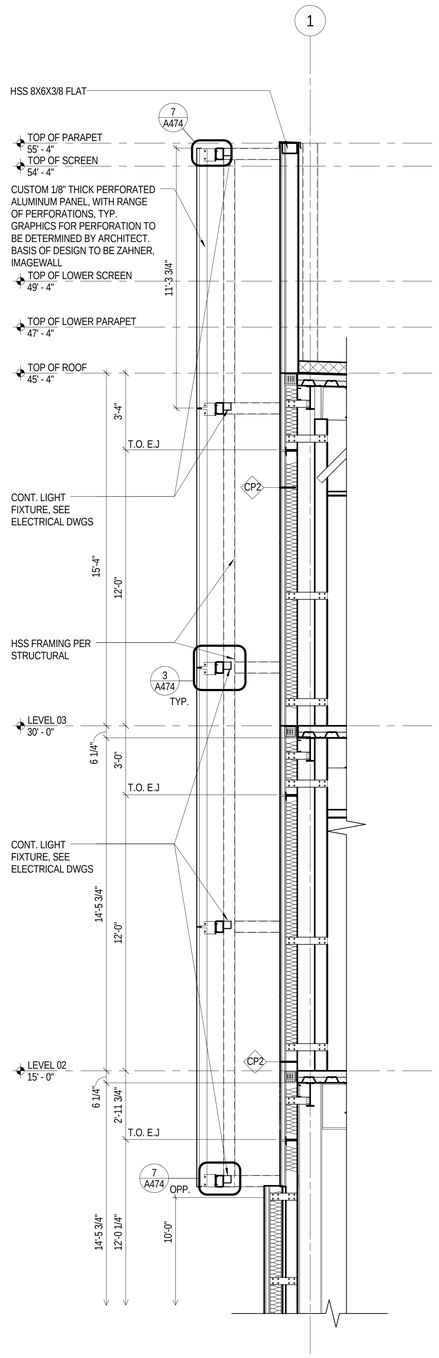
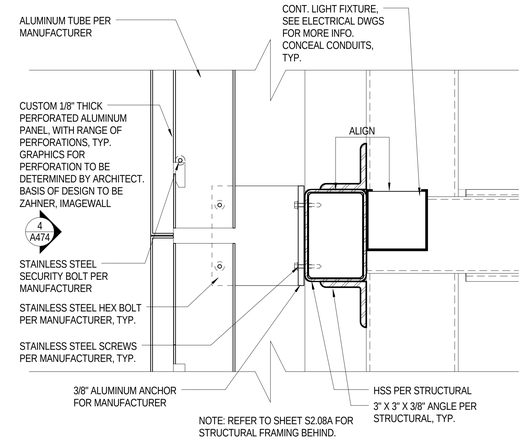


4 ENLARGED ELEVATION DETAIL- ALTERNATE #5
3" = 1'-0"

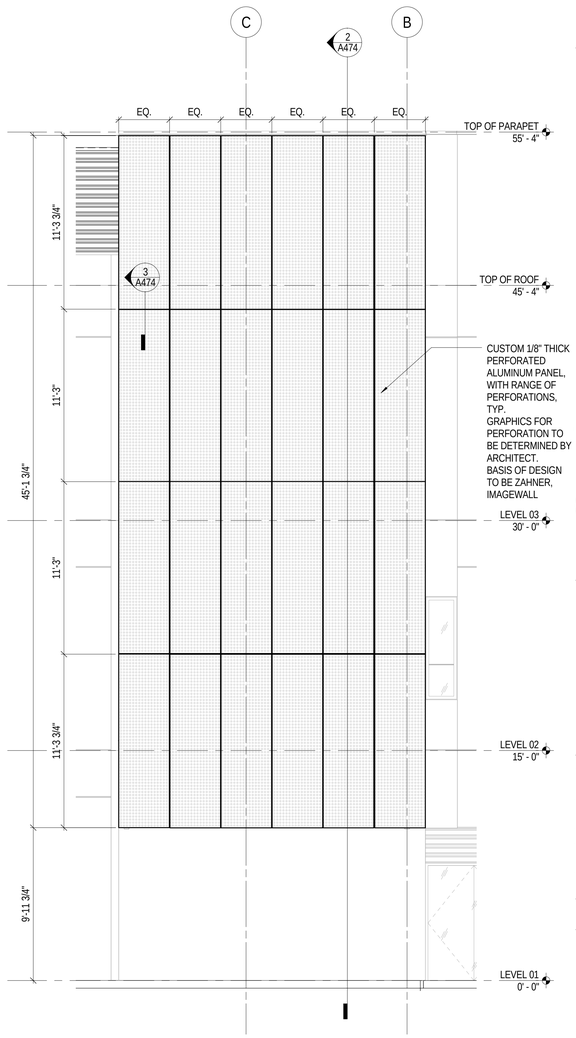


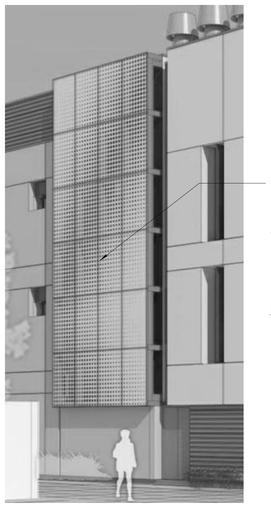
NOTE: SEE 3/A426 FOR ADDITIONAL WALL SECTION INFORMATION AND STRUCTURAL SHEET S2.08A FOR MORE DETAILS.

2 WALL SECTION (AT MURAL)- ALTERNATE #5
3/8" = 1'-0"



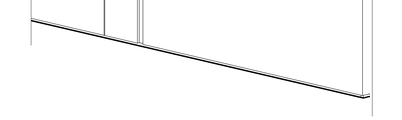
3 ENLARGED SECTION DETAIL- ALTERNATE #5
3" = 1'-0"

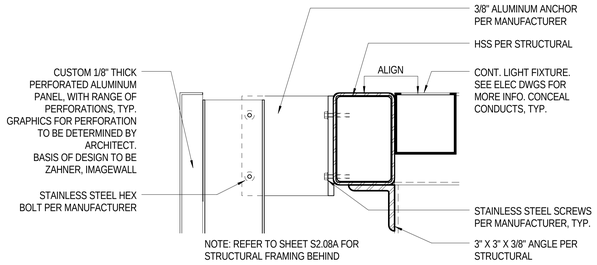




RANGE OF OPENING PERCENTAGE FOR PERFORATIONS ON ECH PANEL SHALL CREATE A GRADIENT PATTERN AS INDICATED IN THIS RENDERING, WHICH IS PROVIDED FOR DESIGN INTENT. ACTUAL PERFORATION PATTERN SHALL BE COORDINATED WITH METAL PANEL MANUFACTURER.

8 PERSPECTIVE RENDERING, ALTERNATE #5





7 ENLARGED SECTION DETAIL AT ALUMINUM PANEL- ALTERNATE #5
3" = 1'-0"

5 MURAL AXON- ALTERNATE #5 (FOR REFERNCE ONLY)

1 MURAL ELEVATION- ALTERNATE #5
1/4" = 1'-0"

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SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON — LICENSED ARCHITECT — REGISTERED PROFESSIONAL ENGINEER — SEPTEMBER 30, 2019 — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

ALTERNATE #5- MURAL ELEVATION, SECTION, DETAILS

DATE: JULY 06, 2017

3 A474 ADDENDA PACKAGE

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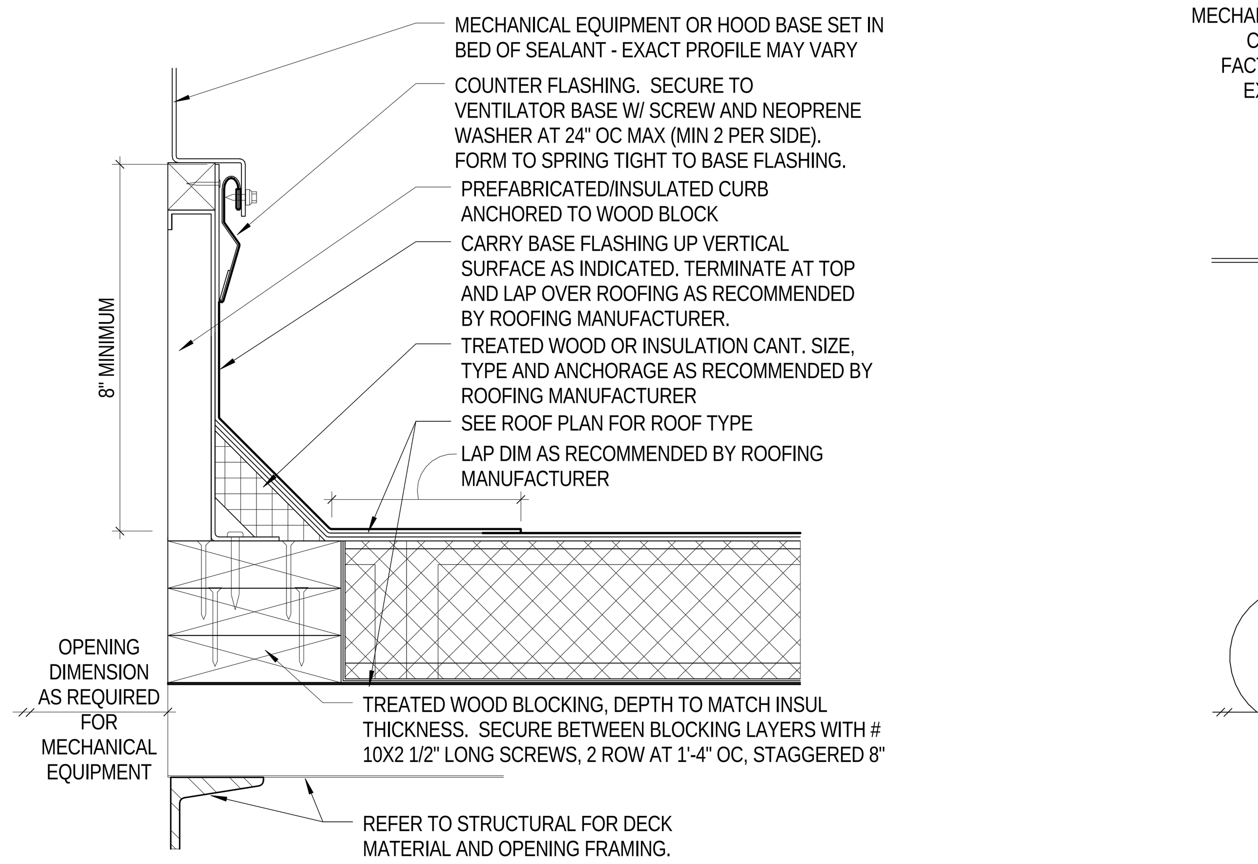
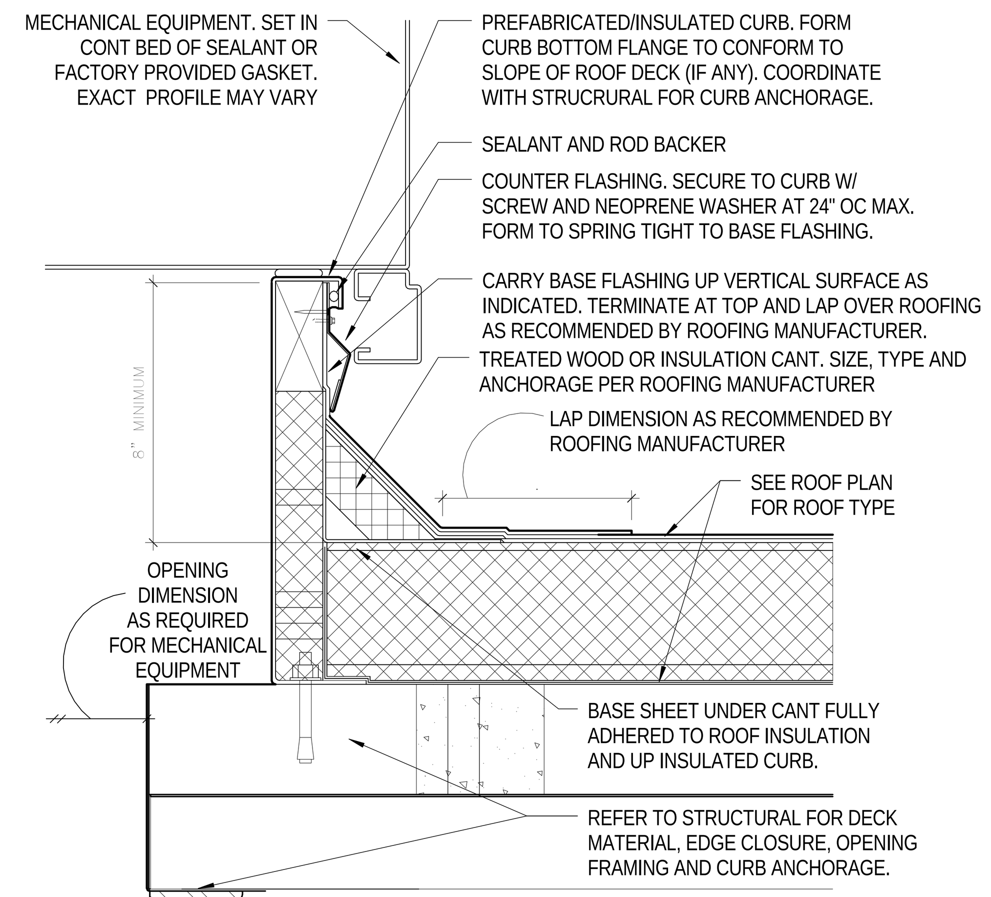


NOTE: THIS DETAIL ILLUSTRATES GENERAL INFORMATION ONLY REGARDING ROOFING MEMBRANE INSTALLATION. REFER TO THE MANUFACTURER'S DETAILS AND INSTALLATION INSTRUCTIONS FOR SPECIFIC AND COMPLETE INFORMATION.

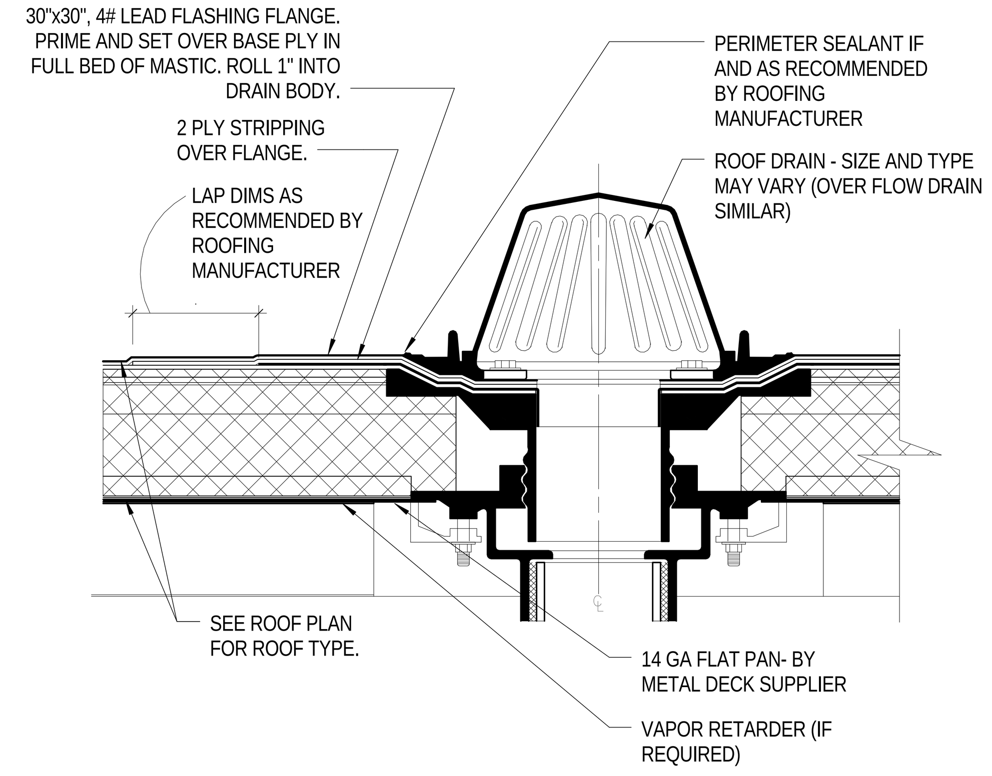
14 PRE-FABRICATED, CURB-MOUNTED VENTILATOR CURB- MBR SERIES
3" = 1'-0"



NOTE: THIS DETAIL ILLUSTRATES GENERAL INFORMATION ONLY REGARDING ROOFING MEMBRANE INSTALLATION. REFER TO THE MANUFACTURER'S DETAILS AND INSTALLATION INSTRUCTIONS FOR SPECIFIC AND COMPLETE INFORMATION.

11 PREFABRICATED, DECK-MOUNTED MECHANICAL EQUIPMENT- MBR SERIES
3" = 1'-0"

NOTE:
EXACT PROFILE OF ROOF DRAIN ELEMENTS MAY VARY



NOTE: THIS DETAIL ILLUSTRATES GENERAL INFORMATION ONLY REGARDING ROOFING MEMBRANE INSTALLATION. REFER TO THE MANUFACTURER'S DETAILS AND INSTALLATION INSTRUCTIONS FOR SPECIFIC AND COMPLETE INFORMATION.

8 ROOF DRAIN AT METAL DECK- MBR SERIES
3" = 1'-0"

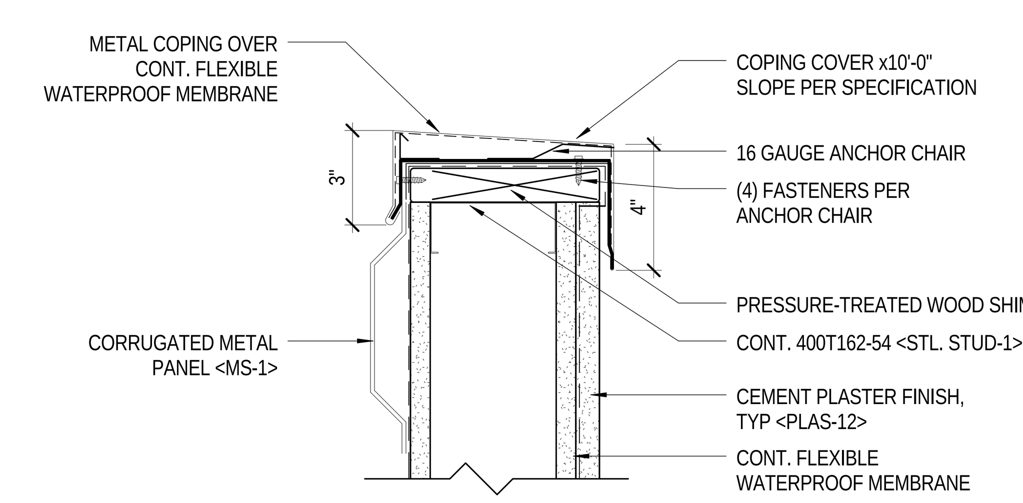
A. DETAILS OF ROOFING MEMBRANE CONFIGURATIONS ARE DIAGRAMMATIC.

B. REFER TO ROOF PLAN FOR LOCATION AND EXTENT OF ROOF TYPES AND OTHER INFORMATION SUCH AS INSULATION THICKNESS, SLOPE, OTHER NOTES AND SOME DETIAL REFERENCING.

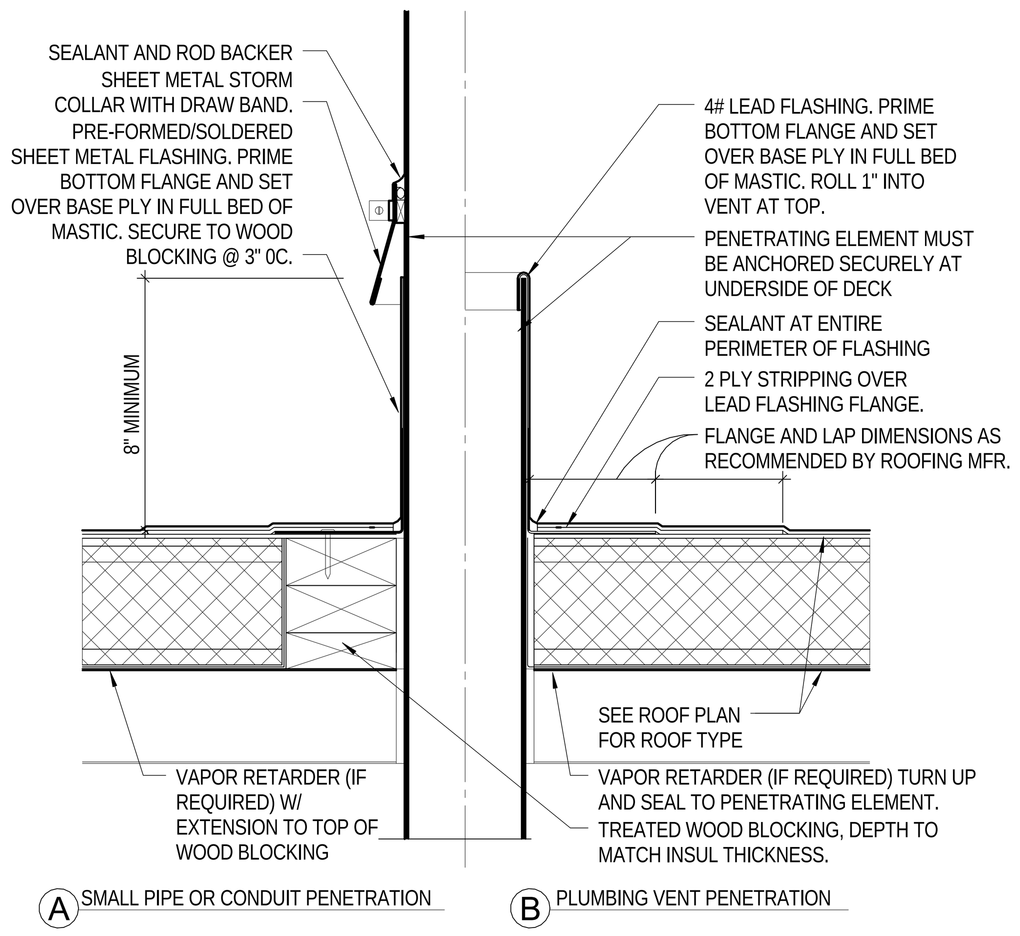
C. VAPOR RETARDER WHEN PROVIDED SHALL BE CONTINUOUS.

D. DIMENSIONAL CRITERIA FOR WOOD BLOCKING SHOWN IN THE DETAILS MUST BE MAINTAINED. EXACT PROFILE MAY VARY WITH PRIOR APPROVAL OF THE ARCHITECT.

5 ROOFING GENERAL NOTES
12" = 1'-0"

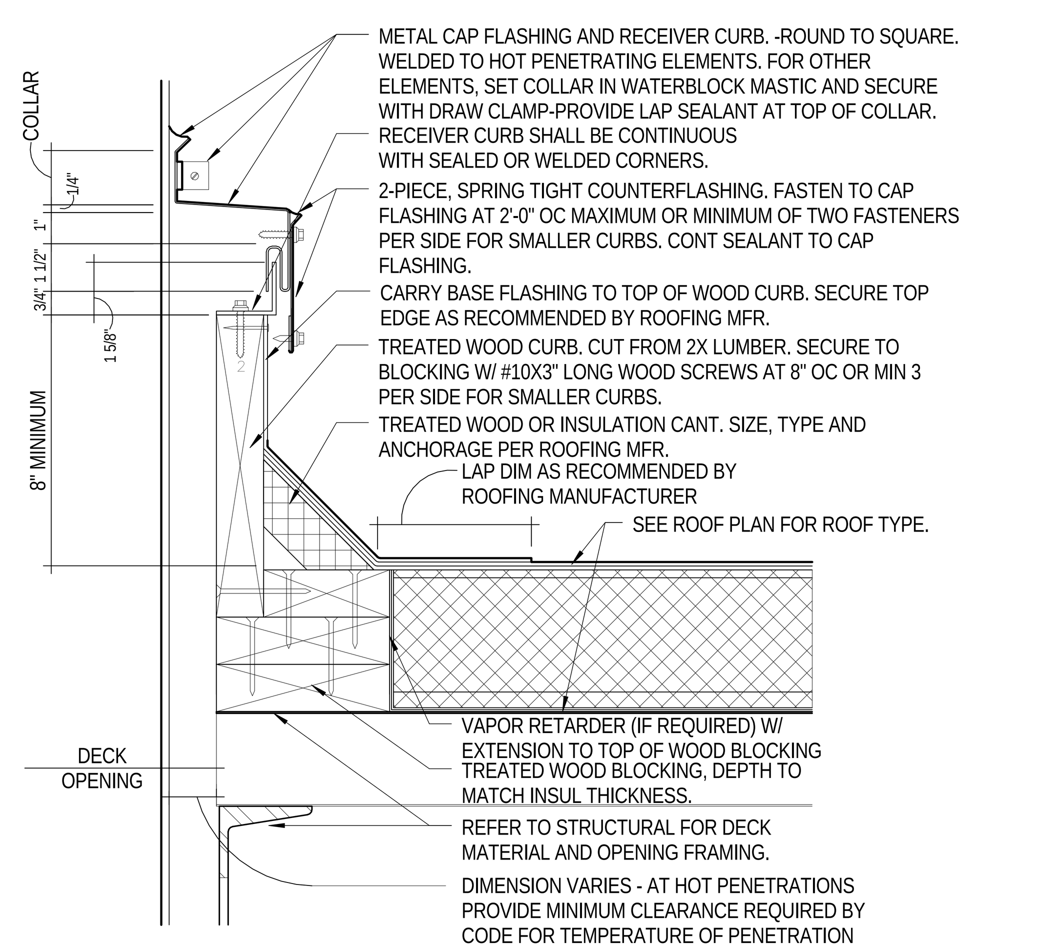


4 PARAPET COPING CAP DETAIL
3" = 1'-0"



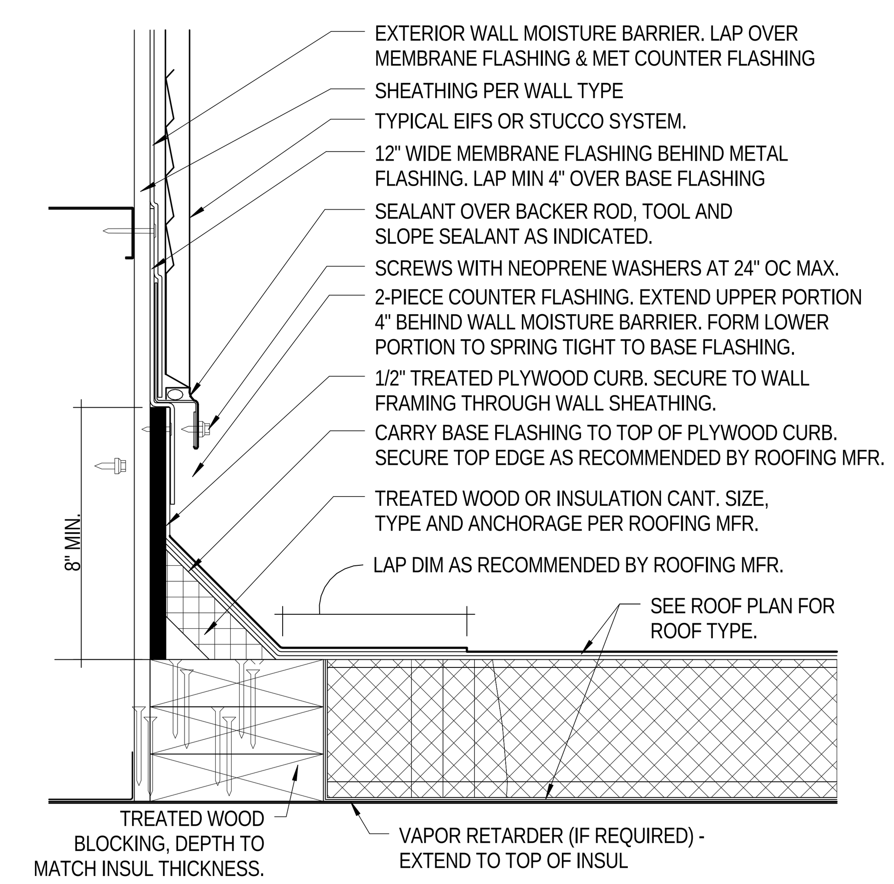
NOTE: THIS DETAIL ILLUSTRATES GENERAL INFORMATION ONLY REGARDING ROOFING MEMBRANE INSTALLATION. REFER TO THE MANUFACTURER'S DETAILS AND INSTALLATION INSTRUCTIONS FOR SPECIFIC AND COMPLETE INFORMATION.

13 PREFABRICATED, ROOF PENETRATION FLASHING- MBR SERIES
3" = 1'-0"



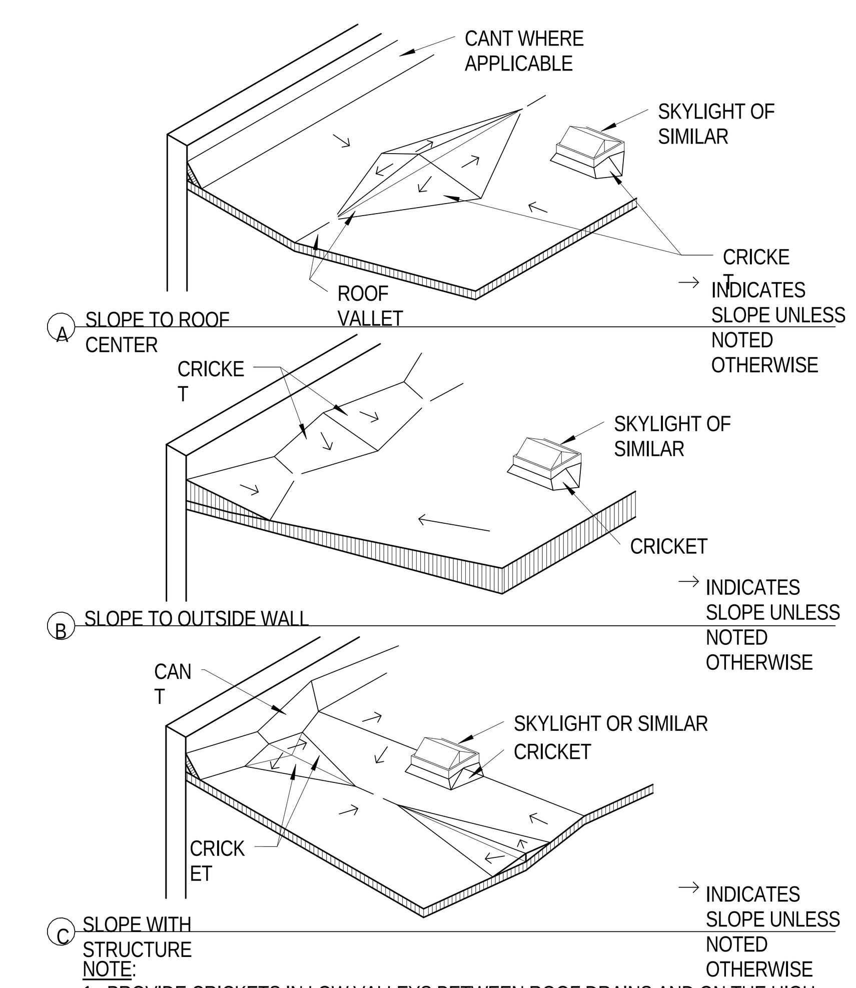
NOTE: THIS DETAIL ILLUSTRATES GENERAL INFORMATION ONLY REGARDING ROOFING MEMBRANE INSTALLATION. REFER TO THE MANUFACTURER'S DETAILS AND INSTALLATION INSTRUCTIONS FOR SPECIFIC AND COMPLETE INFORMATION.

10 FLASHING AT HOT OR MOVING PENETRATION-MBR SERIES
3" = 1'-0"



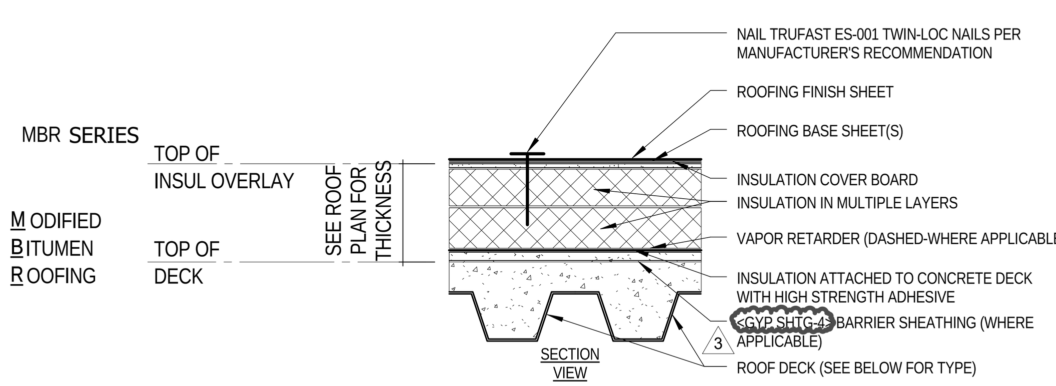
NOTE: THIS DETAIL ILLUSTRATES GENERAL INFORMATION ONLY REGARDING ROOFING MEMBRANE INSTALLATION. REFER TO THE MANUFACTURER'S DETAILS AND INSTALLATION INSTRUCTIONS FOR SPECIFIC AND COMPLETE INFORMATION.

7 ROOF TO WALL TRANSITION- MBR SERIES
3" = 1'-0"



NOTE:
1. PROVIDE CRICKETS IN LOW VALLEYS BETWEEN ROOF DRAINS AND ON THE HIGH SIDE OF ALL CURBS.
2. REFER TO ROOF PLAN FOR PROJECT SLOPE CONFIGURATIONS.
3. REFER TO ROOF TYPES FOR ROOFING MATERIALS.

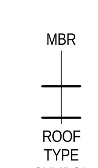
3 CRICKET APPLICATIONS
1 : 1



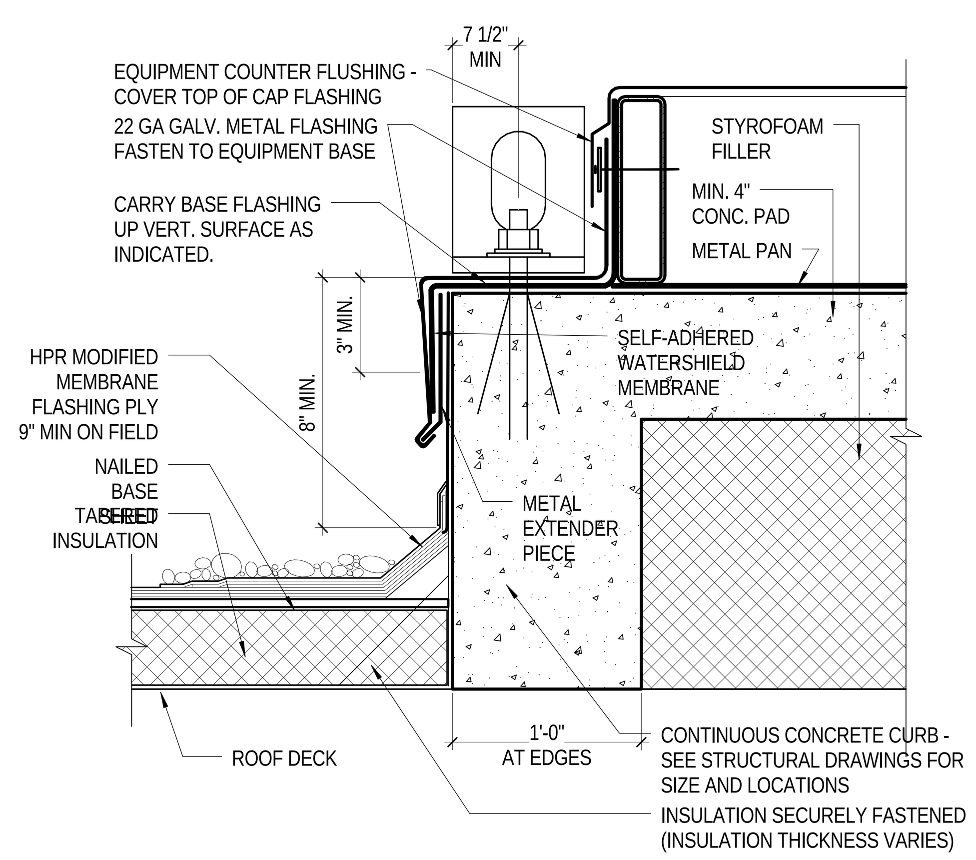
ROOF TYPE	ROOF SYSTEM	ROOFING MEMBRANE (BASE SHEET + CAP SHEET) MATL	APPLIED	FINISH	INSUL COVER BOARD	INSULATION TYPE	TAPER	VAPOR RETARDER	ROOF DECK TYPE	BARRIER	NOTES
MBR-1	SBS	MOD BIT	HOT ASPHALT	GRANU-LAR	MIN 1/4" FGL GYP SHTG	POLYISO W/FACER	NO	2 PLIES MOPPED	CONC	NONE	1-6
IMPORTANT!: VERIFY SYSTEMS, PRODUCTS, AND EXECUTION IN SPECIFICATIONS.											

NOTES:
1. FOLLOW ALL MFR'S REQUIREMENTS FOR MATERIALS AND INSTALLATION TO MAINTAIN WARRANTY.
2. INSTALL VAPOR CONTROL DIRECTLY OVER CONC DECK AND/OR BARRIER SHTG FASTENED TO DECK.
3. EMBED INSUL (IN 2 OR MORE LAYERS) IN HOT ASPHALT OVER VR W/JOINTS STAGGERED.
4. SET INSUL OVERLAY IN HOT ASPHALT OVER COMPLETED INSULATION LAYERS.
5. SEE ROOF PLANS FOR INSUL THICKNESS AND SLOPE AT TAPERED INSUL LOCATIONS.
6. SEE SPECIFICATION AND ROOF PLAN FOR AVERAGE INSULATION R VALUES AND THICKNESS.

NOTE TO DETAILER: MANUFACTURER'S WARRANTY WILL WARY BASED ON SYSTEM AND PRODUCT SELECTION. REVIEW SPECIFIC MANUFACTURER'S REQUIREMENTS FOR LENGHTH OF WARRANTY. ALSO SOME MANUFACTURERS HAVE ADDITIONAL SYSTEMS INCLUDING HEAT WELD, SELF ADHERED AND MECHANICALLY FASTENED PLUS A NUMBER OF INSULATION COVER BOARDS, FINISH COATING PRODUCTS AND VENTED BASE SHEETS. REVIEW SPECIFIC PROJECT REQUIREMENT W/ SYSTEM SUPPLIER FOR MOST APPROPRIATE ASSEMBLY.

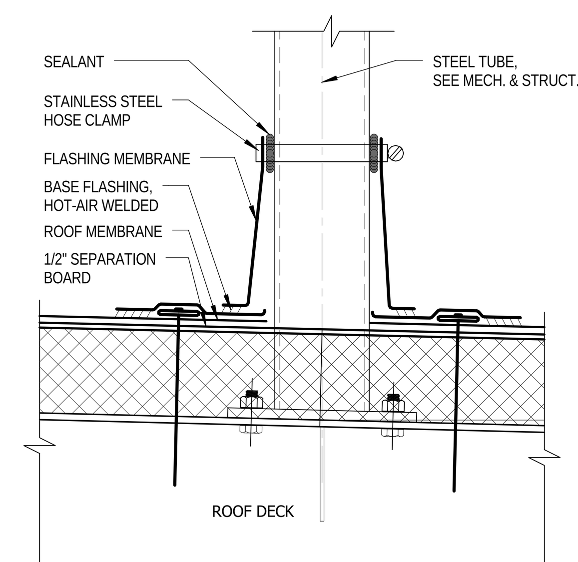


12 ROOF TYPES - MBR SERIES
1 1/2" = 1'-0"



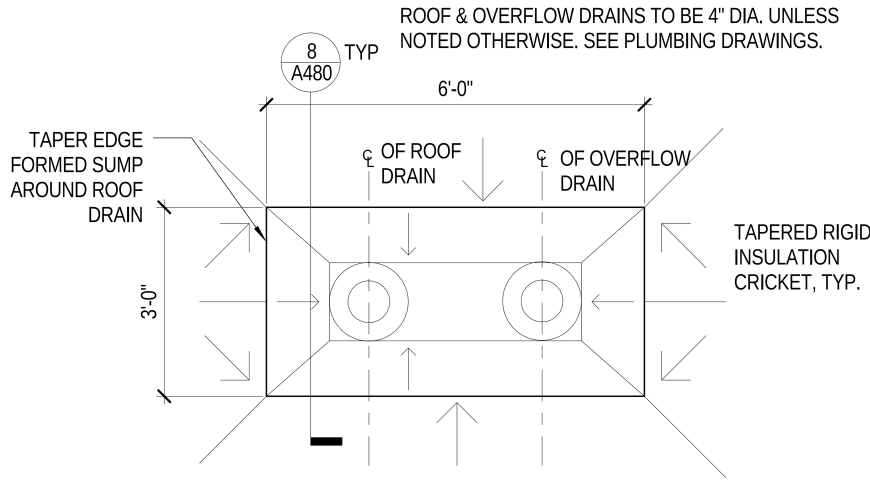
NOTES:
1) NAILERS SHALL BE SECURELY ANCHORED TO THE DECK TO RESIST AS FORCE OF 100 POUNDS PER LINEAR FOOT IN ANY DIRECTION.

9 SUPPORT PAD
3" = 1'-0"

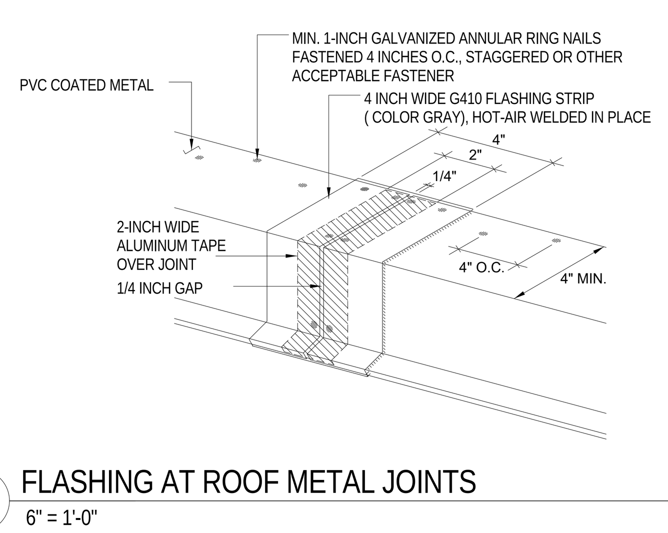


6 TUBE STEEL COLUMN FLASHING AT PENETRATION
3" = 1'-0"

ROOF & OVERFLOW DRAINS TO BE 4" DIA. UNLESS NOTED OTHERWISE. SEE PLUMBING DRAWINGS.



2 ROOF DRAIN, TYP
1/2" = 1'-0"



1 FLASHING AT ROOF METAL JOINTS
6" = 1'-0"

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2019 RENEWAL DATE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK REVIEW BY: TE

HGA NO: 3584-001-00

BUILT-UP ROOF DETAILS - MODIFIED BITUMEN

DATE: JULY 06, 2017

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ADDENDA PACKAGE

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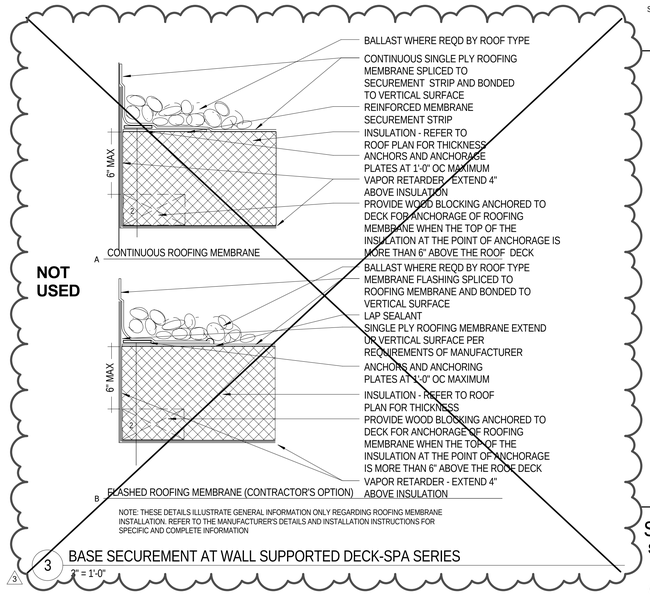
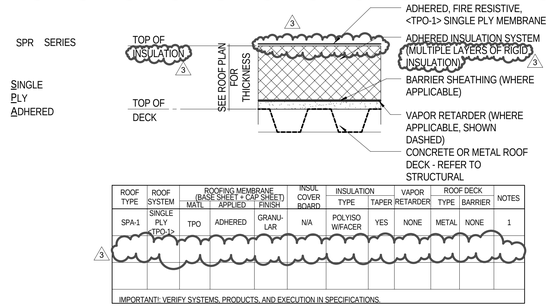


3 BASE SECUREMENT AT WALL SUPPORTED DECK-SPA SERIES

3" = 1'-0"



ROOF TYPE	ROOF SYSTEM	ROOFING MEMBRANE (BASE SHEET + CAP SHEET) MATL	APPLIED	FINISH	INSUL COVER BOARD	INSULATION TYPE	TAPER	VAPOR RETARDER	ROOF DECK TYPE	BARRIER	NOTES
SPA-1	SINGLE PLY <TPO-1>	TPO	ADHERED	GRANU-LAR	N/A	POLYISO W/FACER	YES	NONE	METAL	NONE	1

IMPORTANT! VERIFY SYSTEMS, PRODUCTS, AND EXECUTION IN SPECIFICATIONS.

NOTES:
1. FOLLOW ALL MFR'S REQUIREMENTS FOR MATERIALS AND INSTALLATION TO MAINTAIN WARRANTY.
2. INSTALL VAPOR CONTROL DIRECTLY OVER CONC DECK AND/OR BARRIER SHTG FASTENED TO DECK.
3. SEE ROOF PLANS FOR INSUL THICKNESS AND SLOPE AT TAPERED INSUL LOCATIONS.
4 SEE SPECIFICATION AND ROOF PLAN FOR AVERAGE INSULATION R VALUES AND THICKNESS, IF NOT INDICATED ON ROOF PLAN.

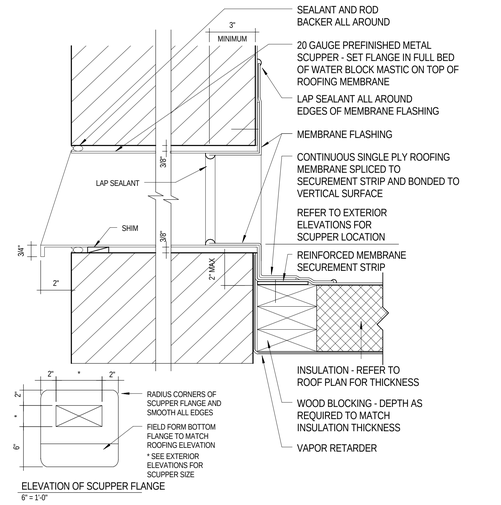
NOTE TO DETAILER: MANUFACTURER'S WARRANTY WILL WARY BASED ON SYSTEM AND PRODUCT SELECTION. REVIEW SPECIFIC MANUFACTURER'S REQUIREMENTS FOR LENGHTH OF WARRANTY. ALSO SOME MANUFACTURERS HAVE ADDITIONAL SYSTEMS INCLUDING MECHANICALLY FASTENED, PLUS A NUMBER OF INSULATION COVER BOARDS, FINISH COATING PRODUCTS REVIEW SPECIFIC PROJECT REQUIREMENT W/ SYSTEM SUPPLIER FOR MOST APPROPRIATE ASSEMBLY.

SPA

ROOF TYPE SYMBOL

2 ROOF TYPES - SPA SERIES

1 1/2" = 1'-0"



6" = 1'-0"

1 SCUPPER-WALL AND ROOF SUPPORTED- SPA SERIES

3" = 1'-0"

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JAMES G. MATSON — No. C13036 — Registration Date — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
1	Addendum 1	8/23/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: TE

HGA NO: 3584-001-00

SINGLE PLY ROOF DETAILS - SPA

DATE: JULY 06, 2017

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ADDENDA PACKAGE

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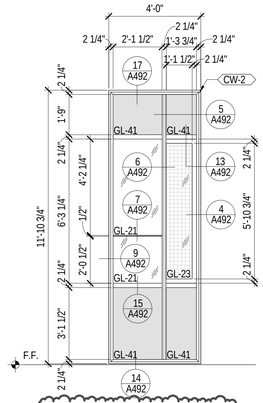
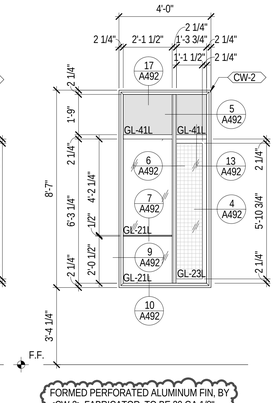


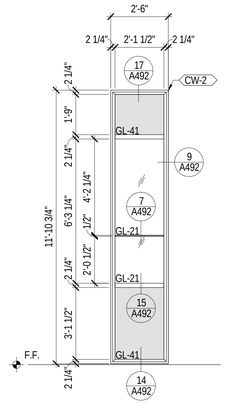
FORMED PERFORATED ALUMINUM FIN, BY <CW-2> FABRICATOR, TO BE 20 GA 1/8" ROUND PERFORATIONS ON 3/16" STAGGERED, COLOR TO MATCH PPG UC121215, DURANAR DARK GRAY (BASIS OF DESIGN: MCNICHOLS) 3

1 W1
3/8" = 1'-0"

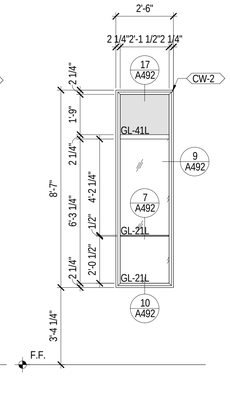


FORMED PERFORATED ALUMINUM FIN, BY <CW-2> FABRICATOR, TO BE 20 GA 1/8" ROUND PERFORATIONS ON 3/16" STAGGERED, COLOR TO MATCH PPG UC121215, DURANAR DARK GRAY (BASIS OF DESIGN: MCNICHOLS) 3

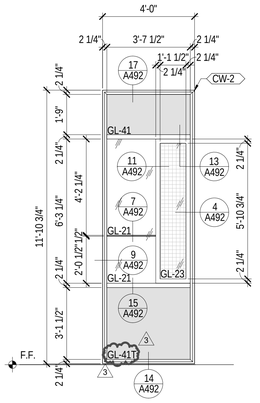
2 W1a
3/8" = 1'-0"



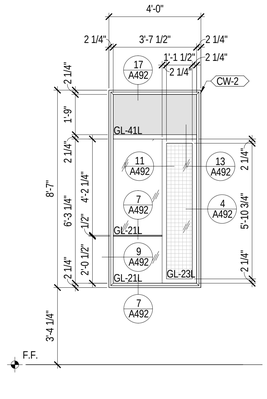
3 W2
3/8" = 1'-0"



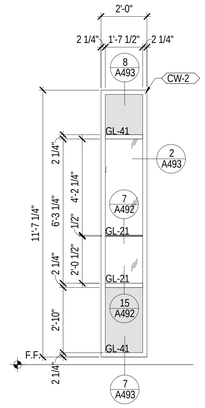
4 W2a
3/8" = 1'-0"



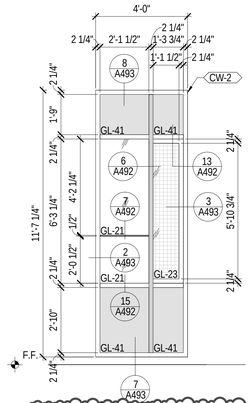
5 W3
3/8" = 1'-0"



6 W3a
3/8" = 1'-0"

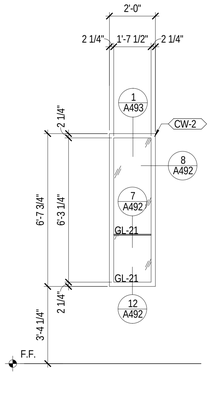


7 W4.
3/8" = 1'-0"

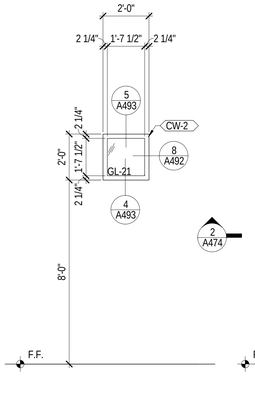


FORMED PERFORATED ALUMINUM FIN, BY <CW-2> FABRICATOR, TO BE 20 GA 1/8" ROUND PERFORATIONS ON 3/16" STAGGERED, COLOR TO MATCH PPG UC121215, DURANAR DARK GRAY (BASIS OF DESIGN: MCNICHOLS) 3

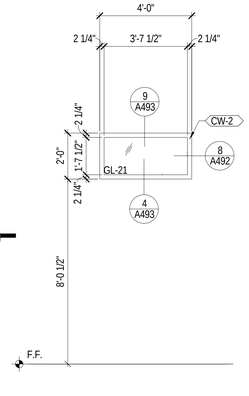
8 W5
3/8" = 1'-0"



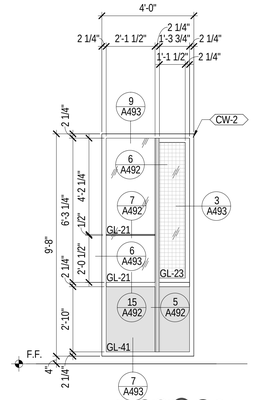
9 W6
3/8" = 1'-0"



10 W7
3/8" = 1'-0"

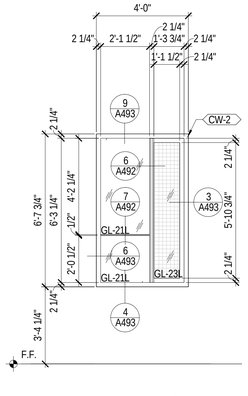


11 W8
3/8" = 1'-0"



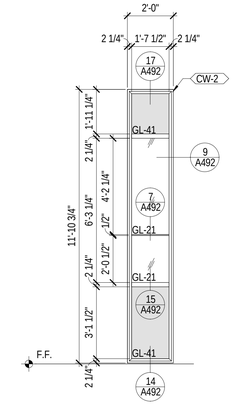
FORMED PERFORATED ALUMINUM FIN, BY <CW-2> FABRICATOR, TO BE 20 GA 1/8" ROUND PERFORATIONS ON 3/16" STAGGERED, COLOR TO MATCH PPG UC121215, DURANAR DARK GRAY (BASIS OF DESIGN: MCNICHOLS) 3

12 W9
3/8" = 1'-0"

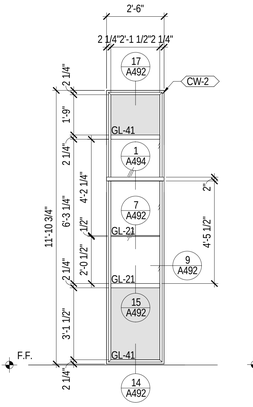


FORMED PERFORATED ALUMINUM FIN, BY <CW-2> FABRICATOR, TO BE 20 GA 1/8" ROUND PERFORATIONS ON 3/16" STAGGERED, COLOR TO MATCH PPG UC121215, DURANAR DARK GRAY (BASIS OF DESIGN: MCNICHOLS) 3

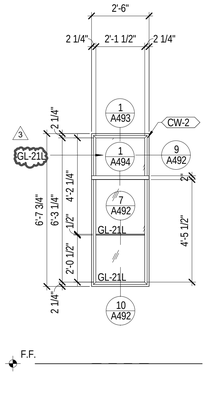
13 W9a
3/8" = 1'-0"



14 W10
3/8" = 1'-0"



15 W11
3/8" = 1'-0"



16 W11a
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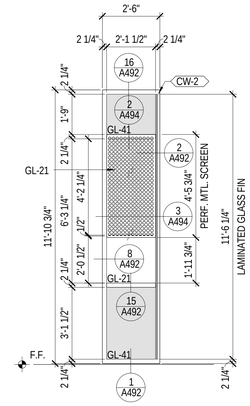
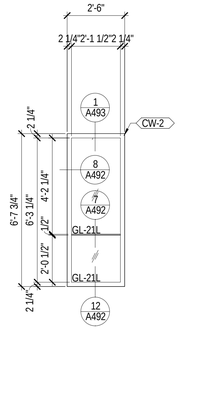


PERFORATED MTL SCREEN, BY <CW-2> FABRICATOR, TO BE EXPANDED METAL, PATTERN: 1/2" #13, COLOR TO MATCH PPG UC121215, DURANAR DARK GRAY (BASIS OF DESIGN: MCNICHOLS) 3

17 W12..
3/8" = 1'-0"



18 W13
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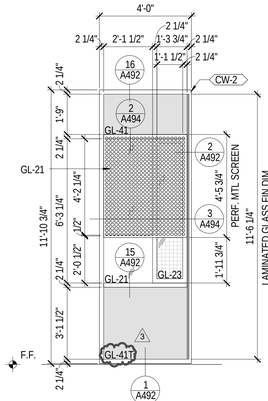
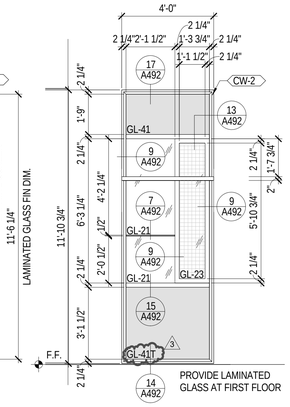


PERFORATED MTL SCREEN, BY <CW-2> FABRICATOR, TO BE EXPANDED METAL, PATTERN: 1/2" #13, COLOR TO MATCH PPG UC121215, DURANAR DARK GRAY (BASIS OF DESIGN: MCNICHOLS) 3

19 W14
3/8" = 1'-0"



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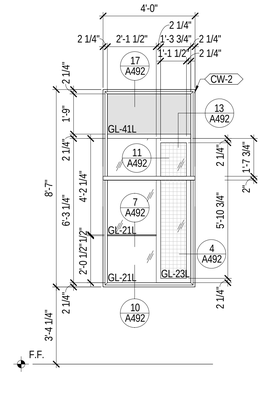

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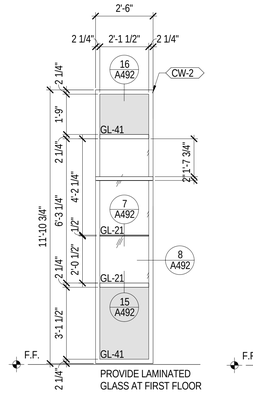

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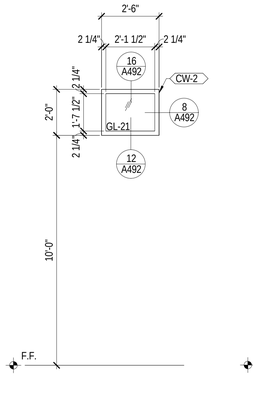

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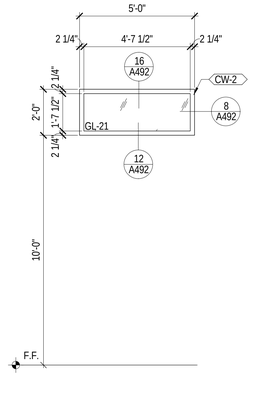

25 W18.
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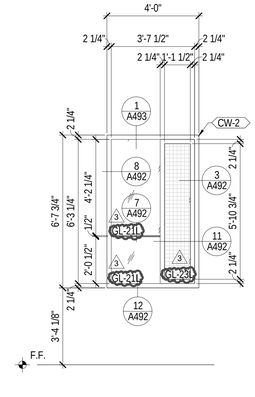

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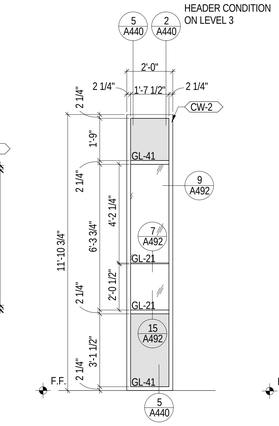
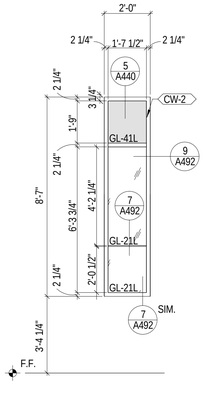


26 W20
3/8" = 1'-0"



27 W20a
3/8" = 1'-0"

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1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

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SANTA ANA COLLEGE

RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON — LICENSED ARCHITECT — No. C13036 — EXPIRES: 31-AUG-2019 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

WINDOW AND CURTAIN WALL TYPES

DATE: JULY 06, 2017

A490

ADDENDA PACKAGE

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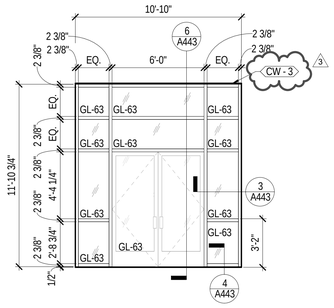
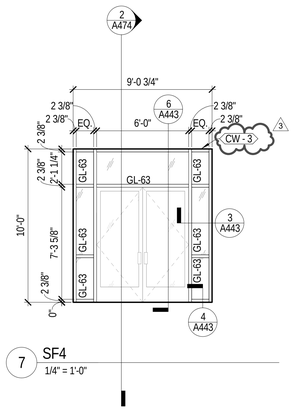


9 SF5
1/4" = 1'-0"



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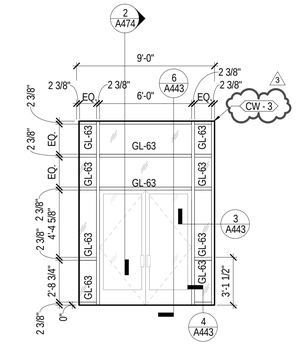
1/4" = 1'-0"



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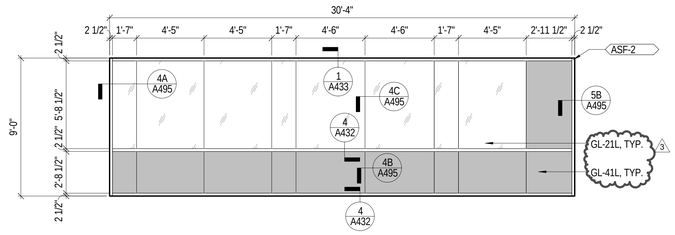
1/4" = 1'-0"



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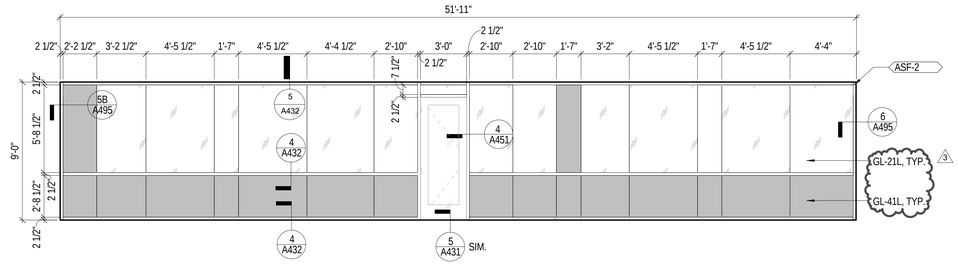

4 SF1
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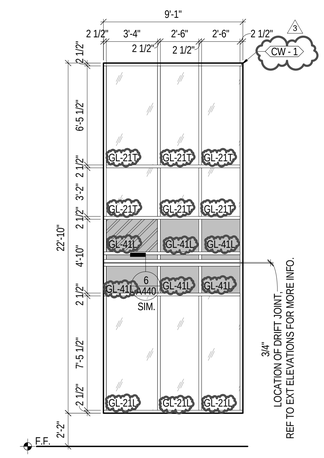
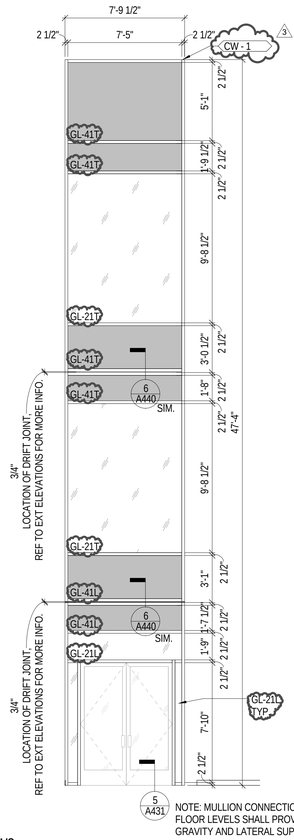


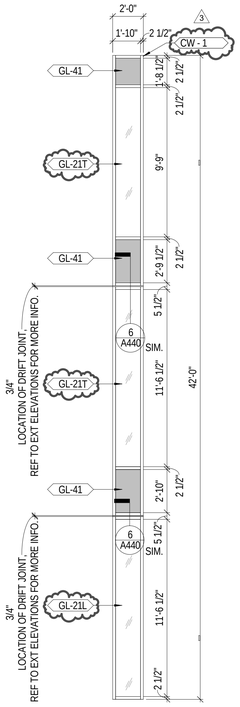
NOTE: MULLION CONNECTION AT FLOOR LEVELS SHALL PROVIDE GRAVITY AND LATERAL SUPPORTS.

10 CW4
1/4" = 1'-0"



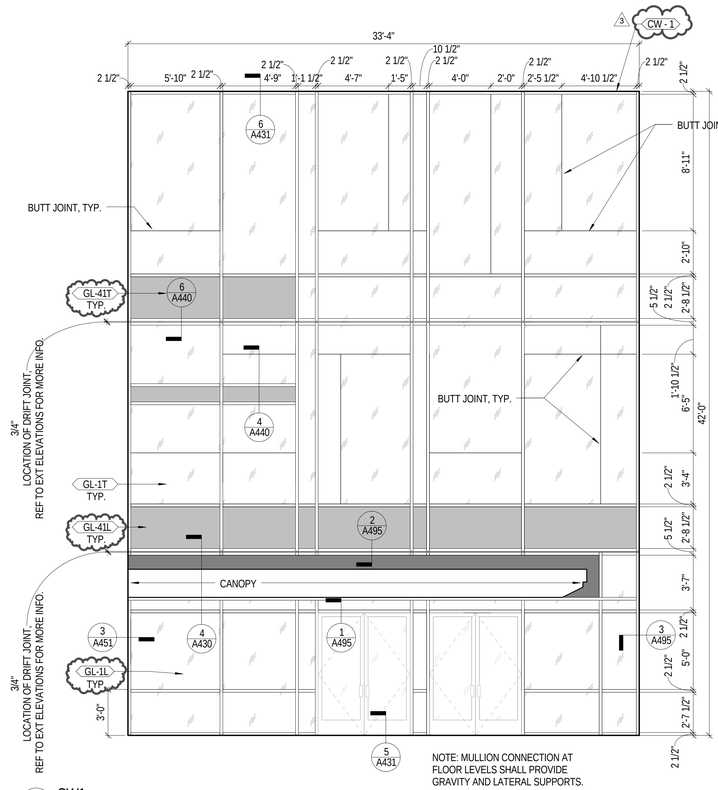
NOTE: MULLION CONNECTION AT FLOOR LEVELS SHALL PROVIDE GRAVITY AND LATERAL SUPPORTS.

3 CW3
1/4" = 1'-0"



NOTE: MULLION CONNECTION AT FLOOR LEVELS SHALL PROVIDE GRAVITY AND LATERAL SUPPORTS.

2 CW2
1/4" = 1'-0"



NOTE: MULLION CONNECTION AT FLOOR LEVELS SHALL PROVIDE GRAVITY AND LATERAL SUPPORTS.

1 CW1
1/4" = 1'-0"

NOTE: ALL EXTERIOR GLASS WITHIN STOREFRONT, WINDOW, OR CURTAINWALL SYSTEMS TO BE LAMINATED GLASS IF LOCATED BELOW 15'-0".

hga.
1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON — No. C13036 — REGISTERED ARCHITECT — SEPTEMBER 30, 2019 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
1	Addendum 1	8/23/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

WINDOW AND CURTAIN WALL TYPES

DATE: JULY 06, 2017

A491

ADDENDA PACKAGE

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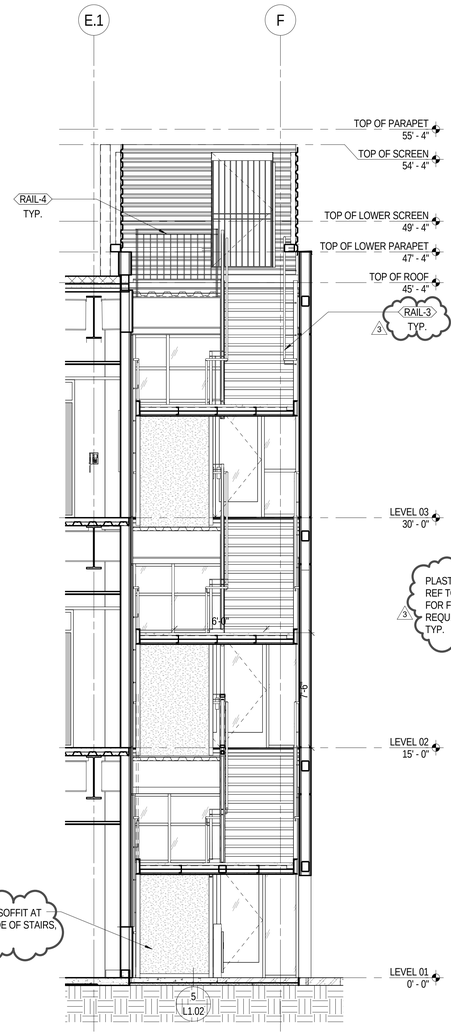
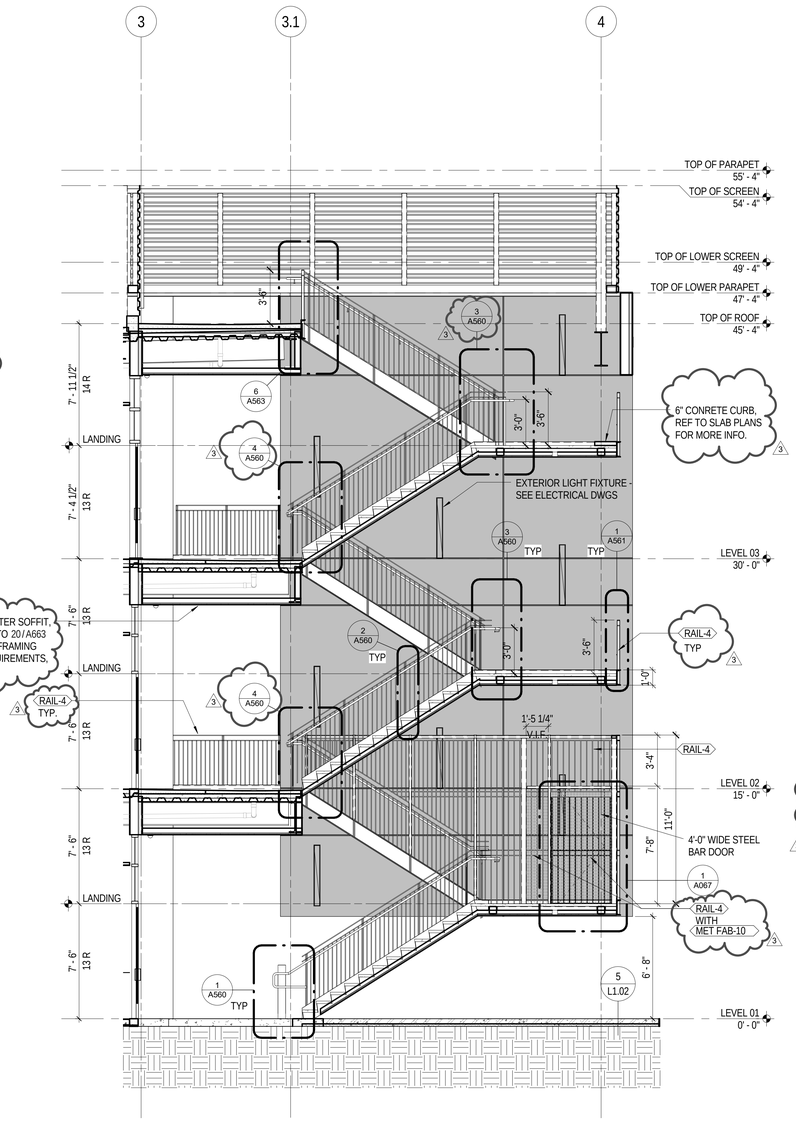


6 STAIR #1 SECTION
1/4" = 1'-0"



5 STAIR #1 SECTION
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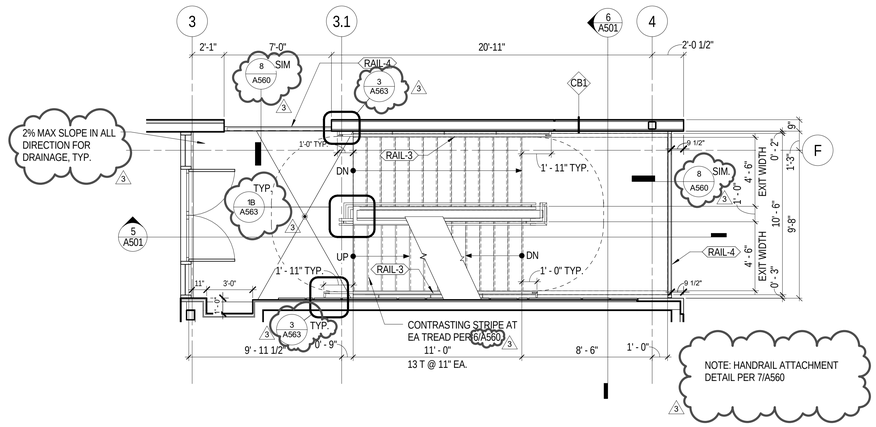
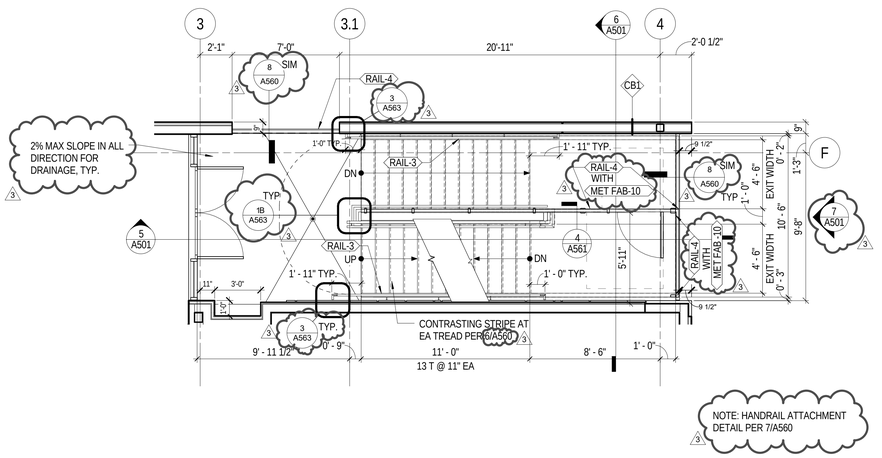
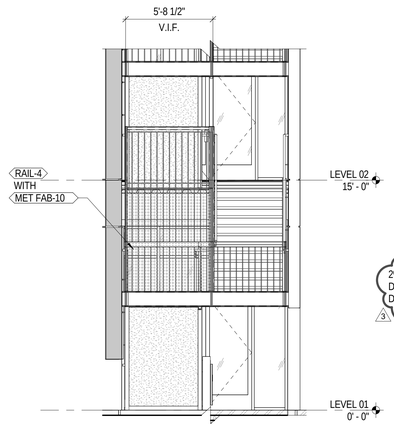


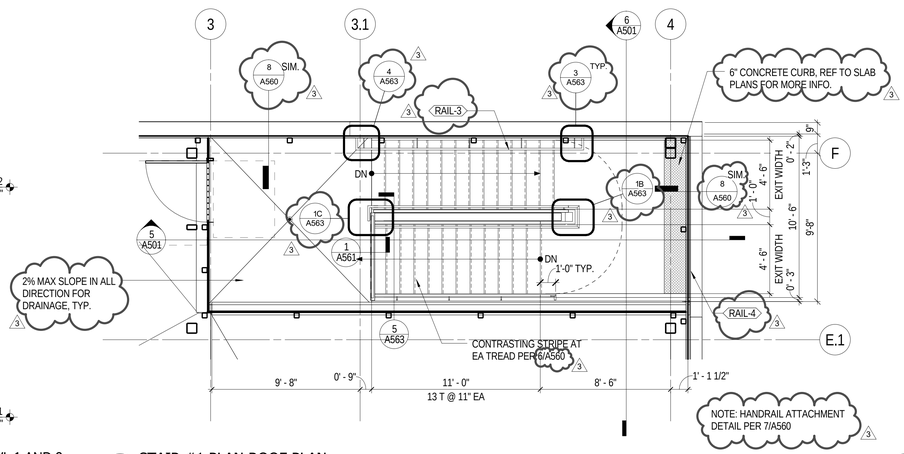
3 STAIR #1 PLAN THIRD FLOOR PLAN
1/4" = 1'-0"



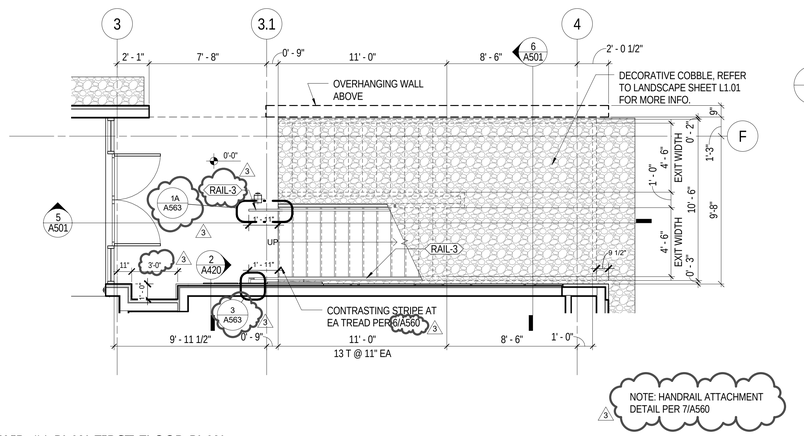
2 STAIR #1 PLAN SECOND FLOOR PLAN
1/4" = 1'-0"



7 STAIR #1 -INTERMEDIATE LANDING BETWEEN LVL 1 AND 2
1/4" = 1'-0"



4 STAIR #1 PLAN ROOF PLAN
1/4" = 1'-0"



1 STAIR #1 PLAN FIRST FLOOR PLAN
1/4" = 1'-0"

1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

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SHERMAN OAKS, CA 91423
818-377-8220

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1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON — No. C13036 — REGISTERED ARCHITECT — EXPIRATION 31-AUG-2019 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

STAIR #1 PLANS AND SECTIONS

DATE: JULY 06, 2017

A501

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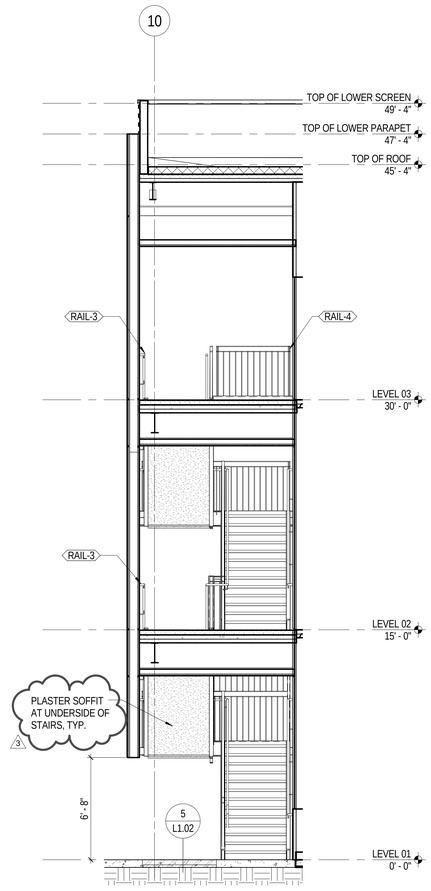
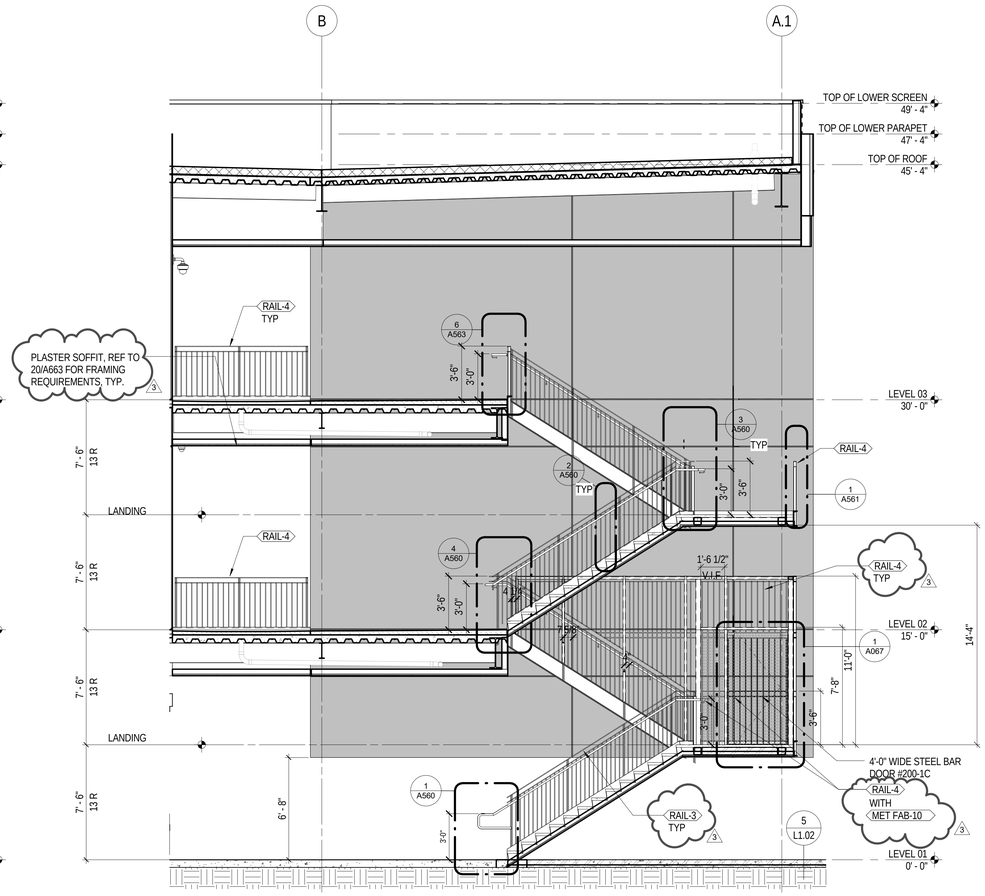
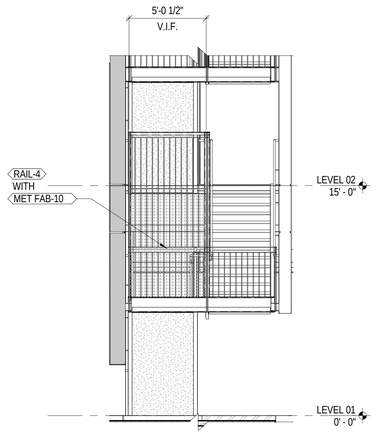


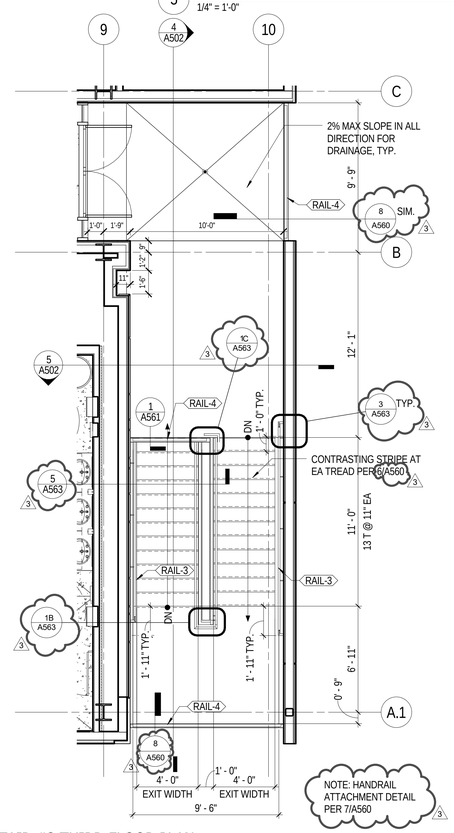
5 STAIR #2 SECTION
1/4" = 1'-0"



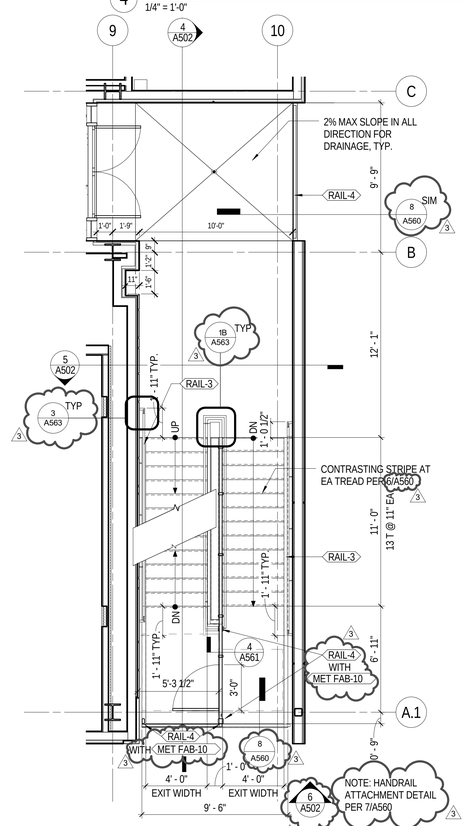
4 STAIR #2 SECTION
1/4" = 1'-0"



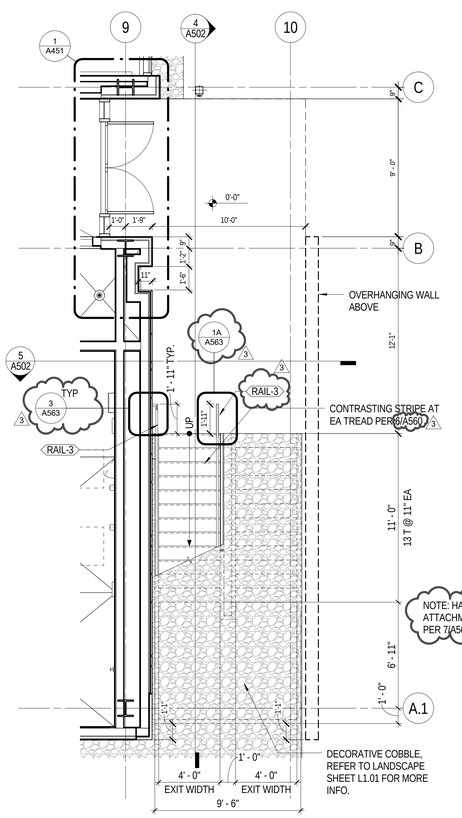
6 STAIR #2 -INTERMEDIATE LANDING BETWEEN LVL 1 AND 2
1/4" = 1'-0"



3 STAIR #2 THIRD FLOOR PLAN
1/4" = 1'-0"



2 STAIR #2 SECOND FLOOR PLAN
1/4" = 1'-0"



1 STAIR #2 FIRST FLOOR PLAN
1/4" = 1'-0"

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DISTRICT

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COLLEGE

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LICENSED ARCHITECT
JAMES G. MATSON
C-13036
SEPTEMBER 30, 2017
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

STAIR #2 PLANS AND SECTIONS

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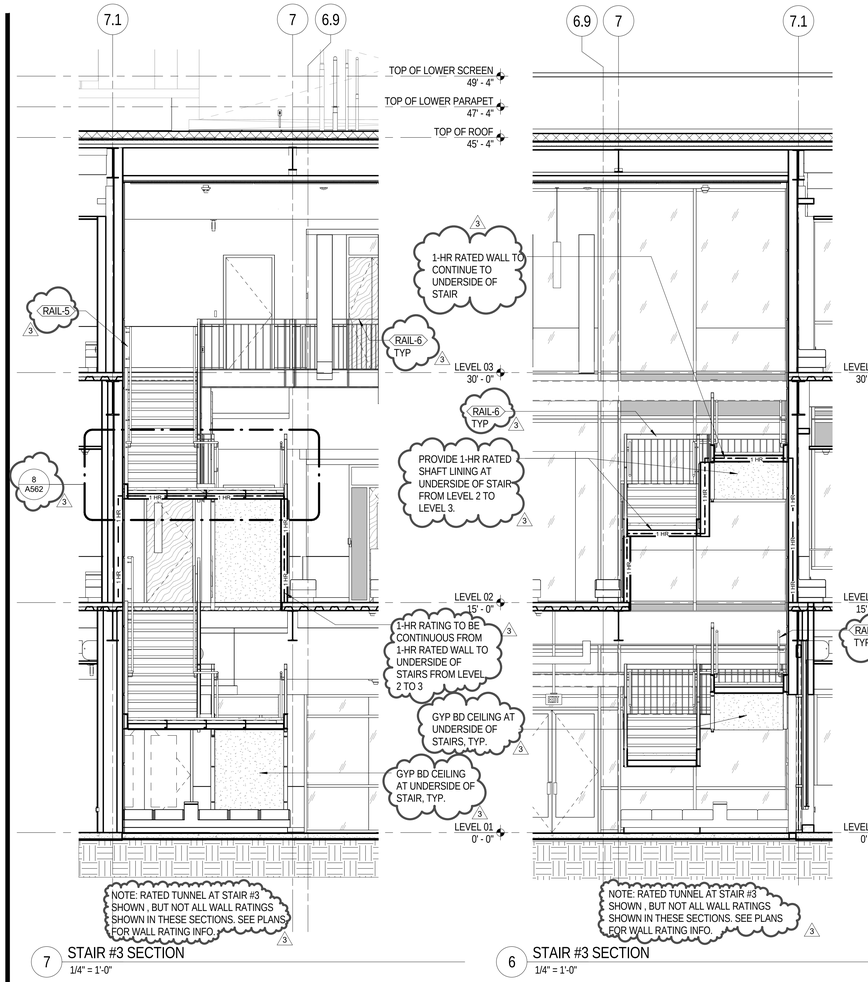
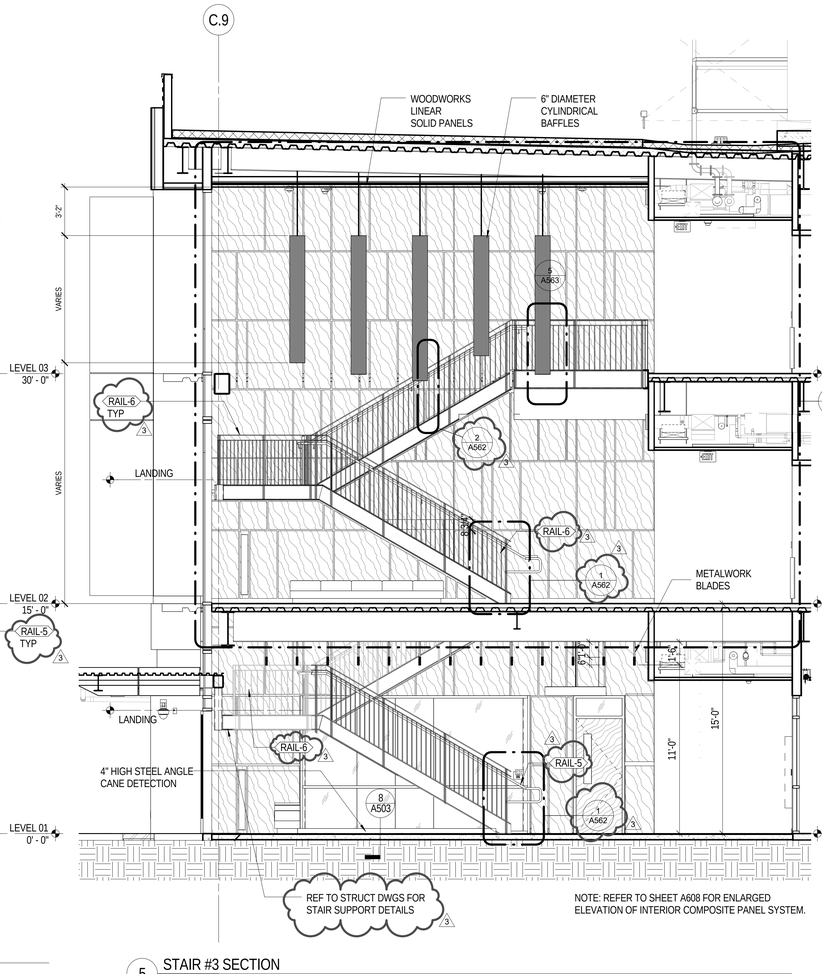
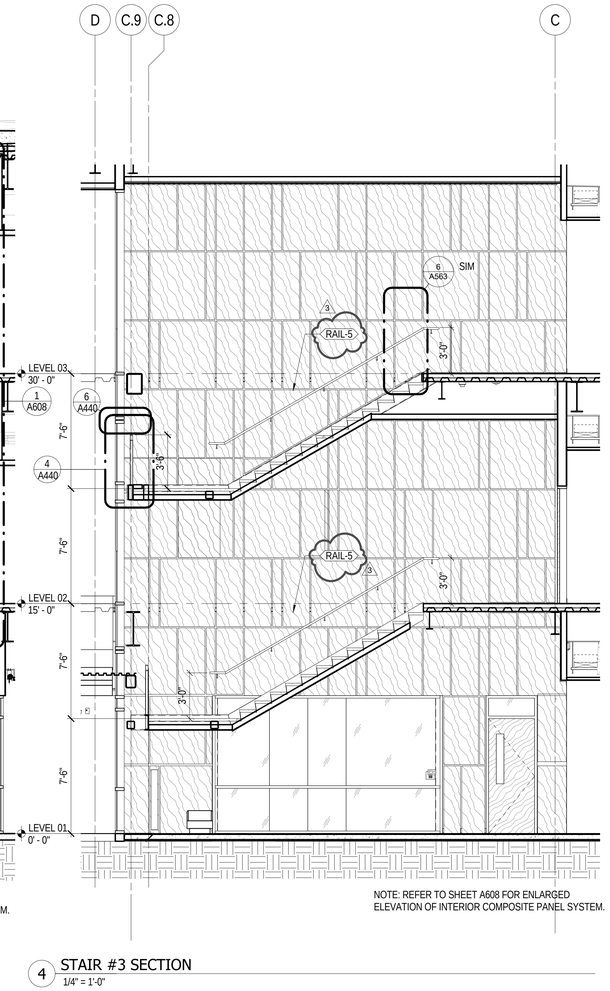


7 STAIR #3 SECTION
1/4" = 1'-0"

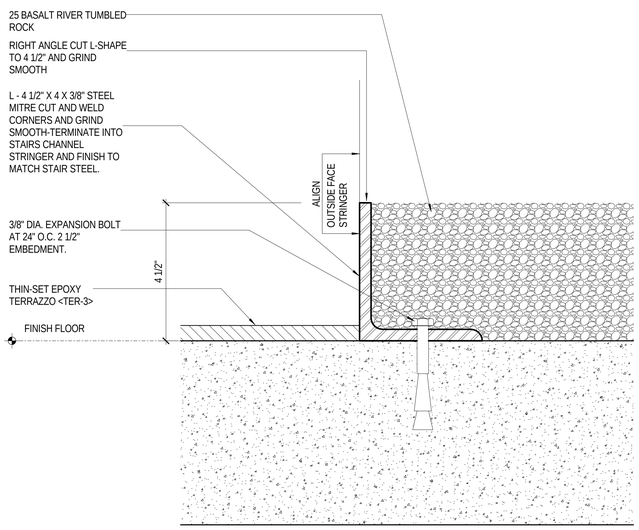
6 STAIR #3 SECTION
1/4" = 1'-0"



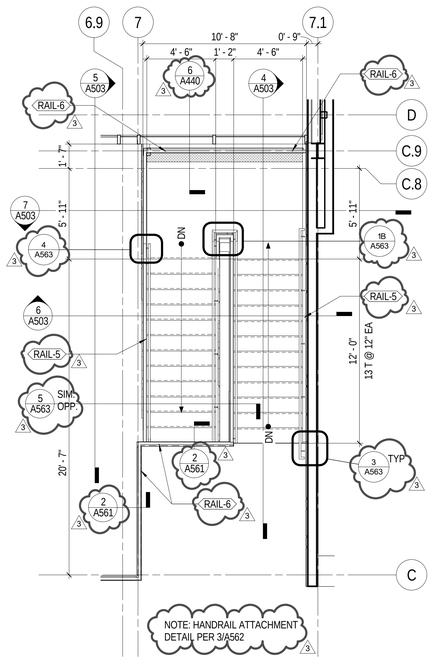
5 STAIR #3 SECTION
1/4" = 1'-0"



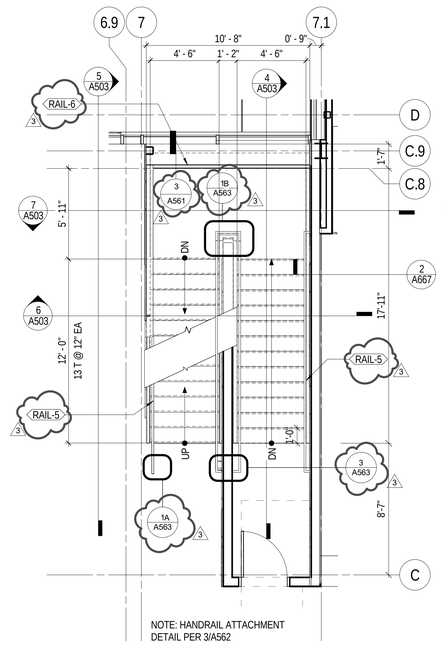
4 STAIR #3 SECTION
1/4" = 1'-0"



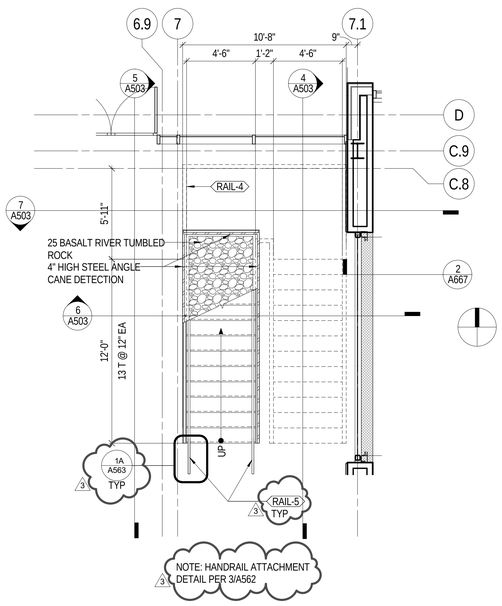
8 CANE DETECTION CURB AT LOBBY STAIRS
6" = 1'-0"



3 STAIR #3 THIRD FLOOR PLAN
1/4" = 1'-0"



2 STAIR #3 SECOND FLOOR PLAN
1/4" = 1'-0"



1 STAIR #3 FIRST FLOOR PLAN
1/4" = 1'-0"

hga.
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Santa Monica , California 90405
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LICENSED ARCHITECT JAMES G. MATSON No. C-13036 STATE OF CALIFORNIA SEPTEMBER 30, 2017 RENEWAL DATE

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

STAIR #3 PLANS AND SECTIONS

DATE: JULY 06, 2017

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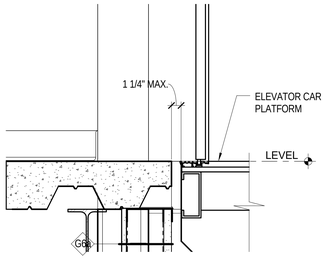
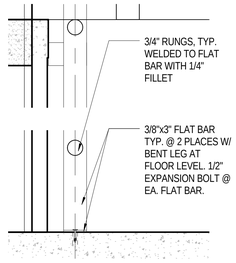
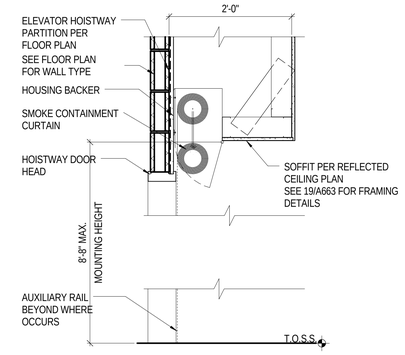


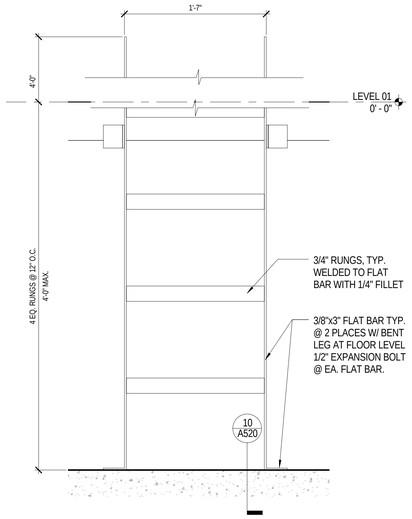
12 ELEVATOR - HOISTWAY LANDING DETAIL
1 1/2" = 1'-0"



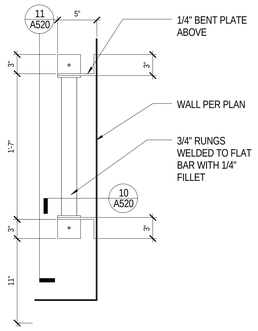
10 ELEVATOR PIT LADDER DETAIL 2
1 1/2" = 1'-0"



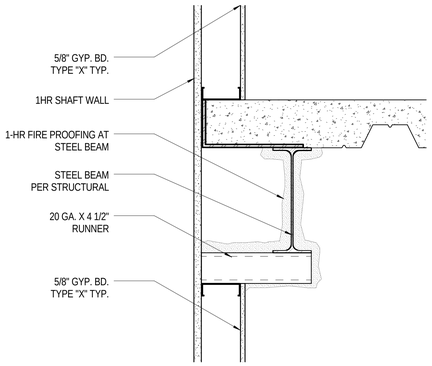
7 SMOKE GUARD HEAD
1" = 1'-0"



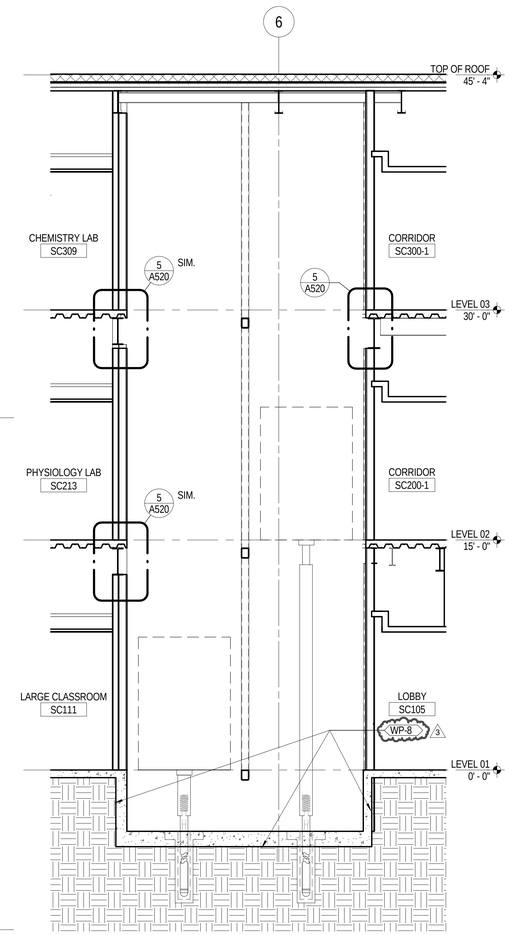
11 ELEVATOR PIT LADDER DETAIL
1 1/2" = 1'-0"



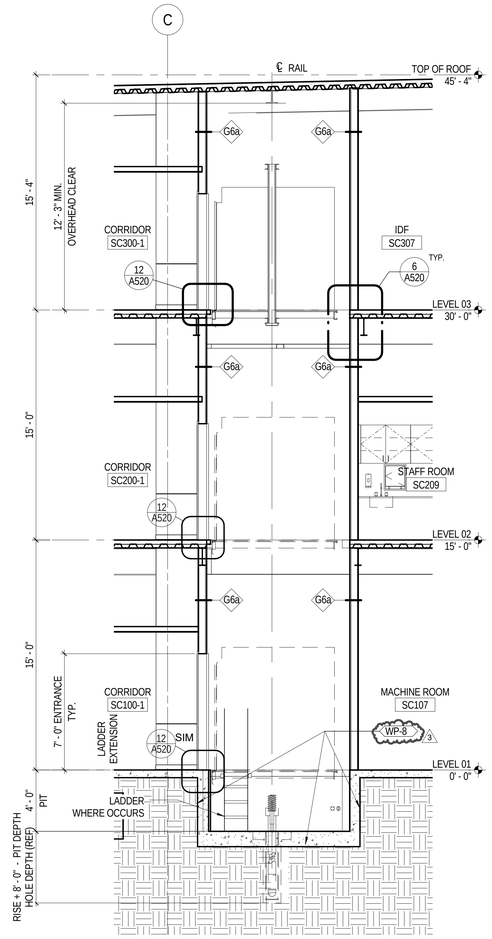
9 PLAN OF LADDER
1 1/2" = 1'-0"



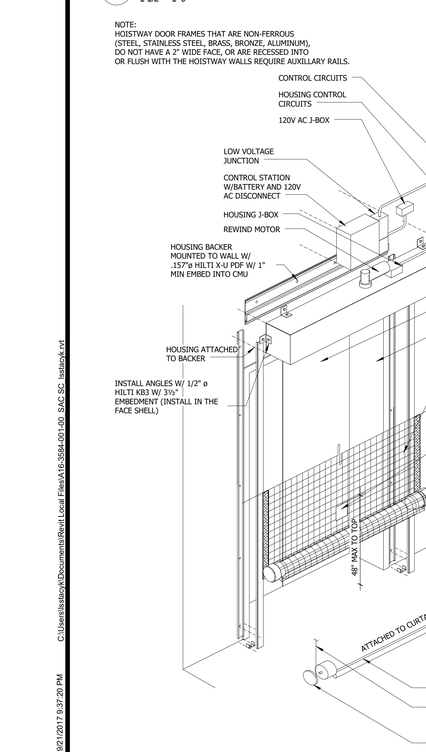
6 WALL DETAIL AT ELEVATOR 2
1 1/2" = 1'-0"



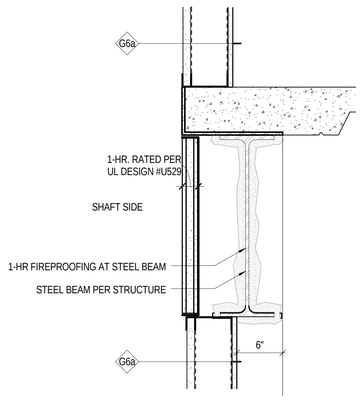
3 ELEVATOR - SECTION 2
1/4" = 1'-0"



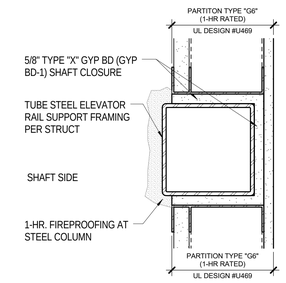
2 ELEVATOR - SECTION 1
1/4" = 1'-0"



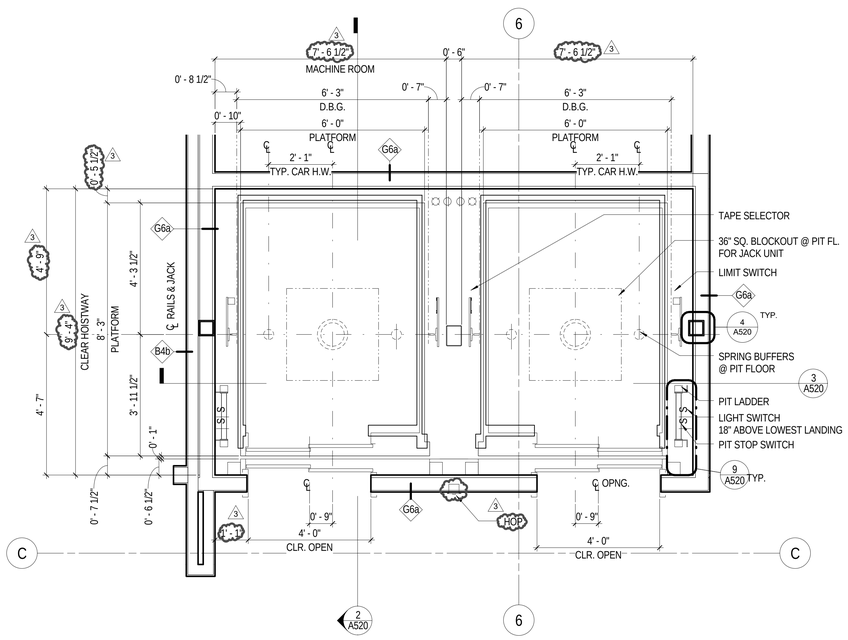
8 SMOKE GUARD
1" = 1'-0"



5 WALL DETAIL AT ELEVATOR 1
1 1/2" = 1'-0"



4 PLAN DETAIL AT ELEV. RAIL SUPPORT FRAMING
3" = 1'-0"



1 ELEVATOR #1 AND #2 PLAN- ENLARGED
1/2" = 1'-0"

GENERAL NOTES:

1. ELEVATOR PUMPS TO BE MOUNTED ON 1" STATIC DEFLECTION SPRING.
2. ALL HYDRAULIC LINES FOR THE ELEVATORS SHALL BE INSTALLED ON NEOPRENE ISOLATORS IF SUSPENDED FROM THE CEILING OR ON SPRING ISOLATORS WITH 0.3" STATIC DEFLECTION IF FLOOR-MOUNTED.
3. PROVIDE MUFFLER ON DISCHARGE OIL LINE FOR THE ELEVATORS.
4. PROVIDE OVERSIZE OPENING IN THE SLAB OR WALL FOR THE OIL LINE PENETRATION THROUGH A SLEEVE FILLED WITH RESILIENT FIRESTOPPING MATERIAL, TYP. FOR THE ELEVATORS.
5. ELEVATOR CYLINDER TO BE MOUNTED ON NEOPRENE PADS (MASON INDUSTRIES TYPE SUPER W OR APPROVED EQUAL) WITH 0.1" STATIC DEFLECTION, TYP.
6. ALL ELECTRICAL CONNECTIONS SHOULD HAVE FLEXIBLE CONDUIT CONNECTING TO THE ELECTRICAL EQUIPMENT, TYP.
7. ELEVATORS TO BE CONNECTED TO EMERGENCY POWER. REF TO ELECTRICAL DWGS FOR MORE INFO.

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Santa Monica, California 90405
Telephone 310.557.7600

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LICENSED ARCHITECT JAMES G. MATSON No. C13036 REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA
SEPTEMBER 30, 2019 RENEWAL DATE

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: TE

HGA NO: 3584-001-00

ELEVATOR 1 & 2 - PLANS AND SECTIONS

DATE: JULY 06, 2017

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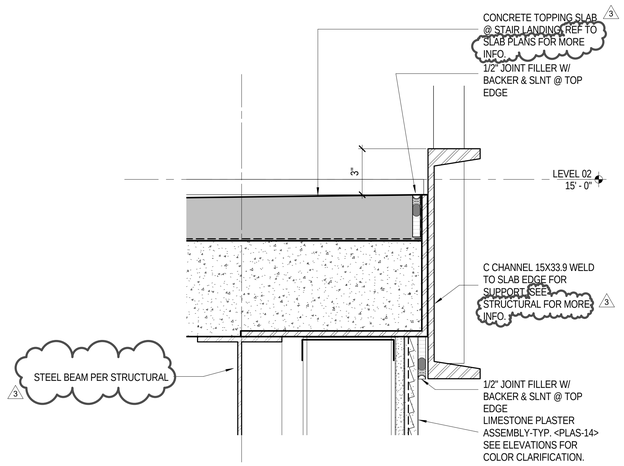
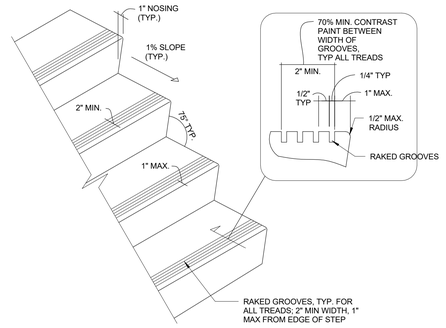
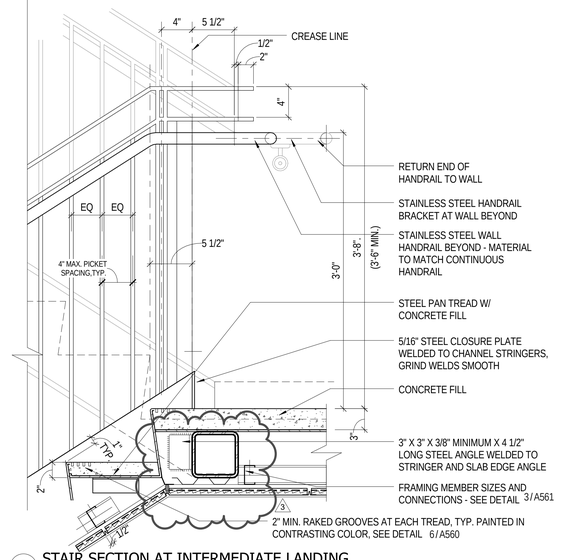


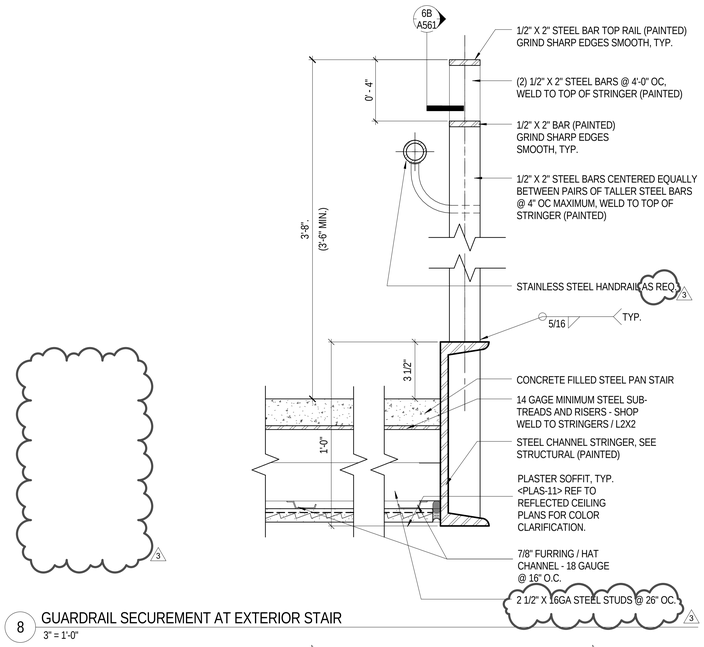
9 GUARDRAIL SECUREMENT AT LANDING
3" = 1'-0"



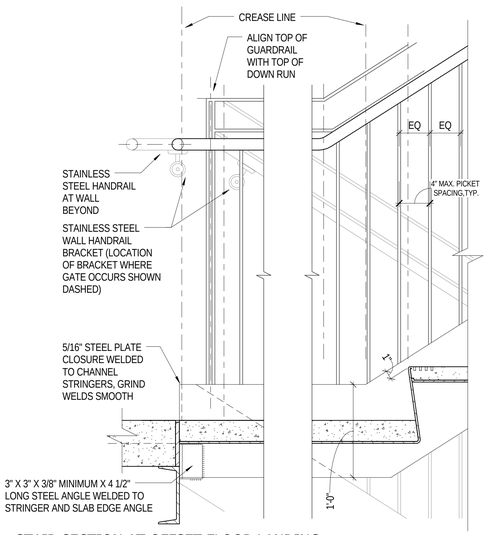
6 CONTRASTING STRIPE @ EXTERIOR CONCRETE STAIRS
1/2" = 1'-0"



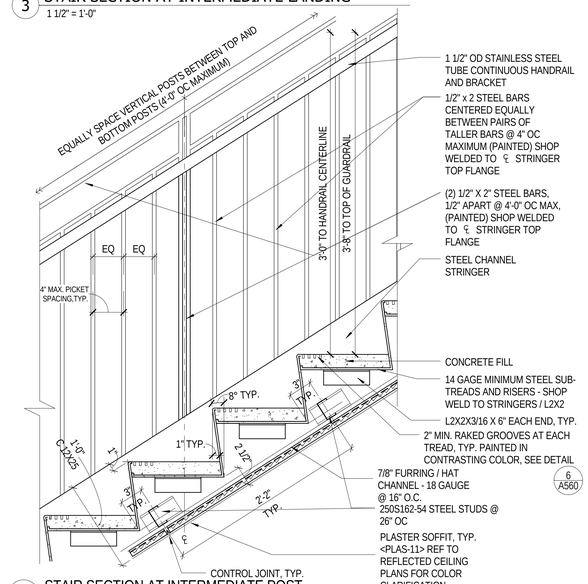
3 STAIR SECTION AT INTERMEDIATE LANDING
1 1/2" = 1'-0"



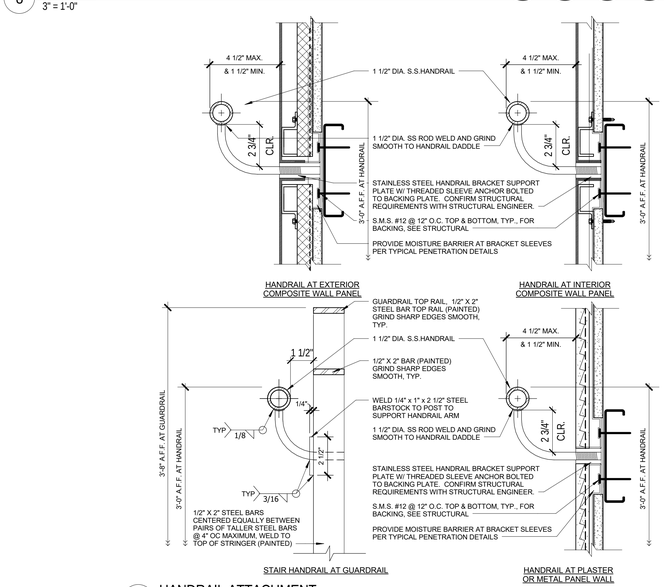
8 GUARDRAIL SECUREMENT AT EXTERIOR STAIR
3" = 1'-0"



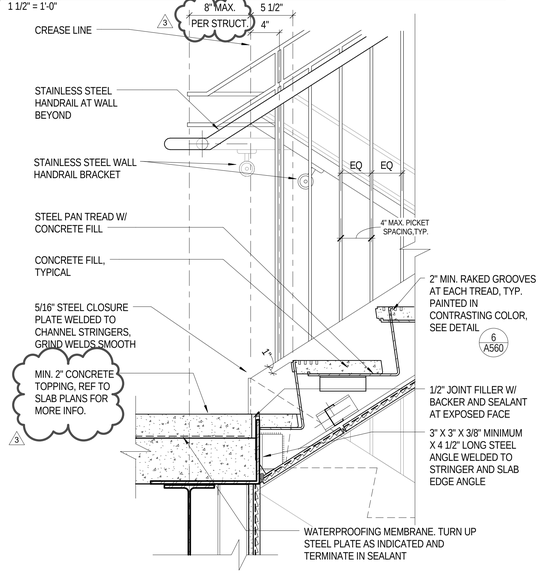
5 STAIR SECTION AT OFFSET FLOOR LANDING
1 1/2" = 1'-0"



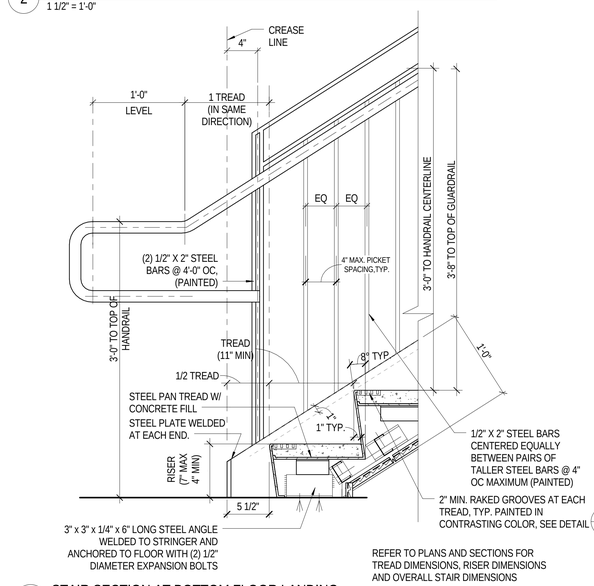
2 STAIR SECTION AT INTERMEDIATE POST
1 1/2" = 1'-0"



7 HANDRAIL ATTACHMENT
3" = 1'-0"



4 STAIR SECTION AT FLOOR LANDING
1 1/2" = 1'-0"



1 STAIR SECTION AT BOTTOM FLOOR LANDING
1 1/2" = 1'-0"

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JAMES G. MATSON — No. C13036 — REGISTERED PROFESSIONAL ENGINEER — SEPTEMBER 30, 2019 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

STAIR DETAILS - STAIR # 1 AND STAIR # 2

DATE: JULY 06, 2017

A560

ADDENDA PACKAGE

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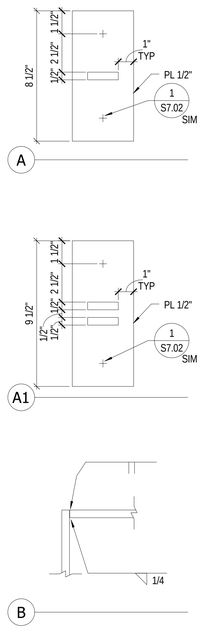
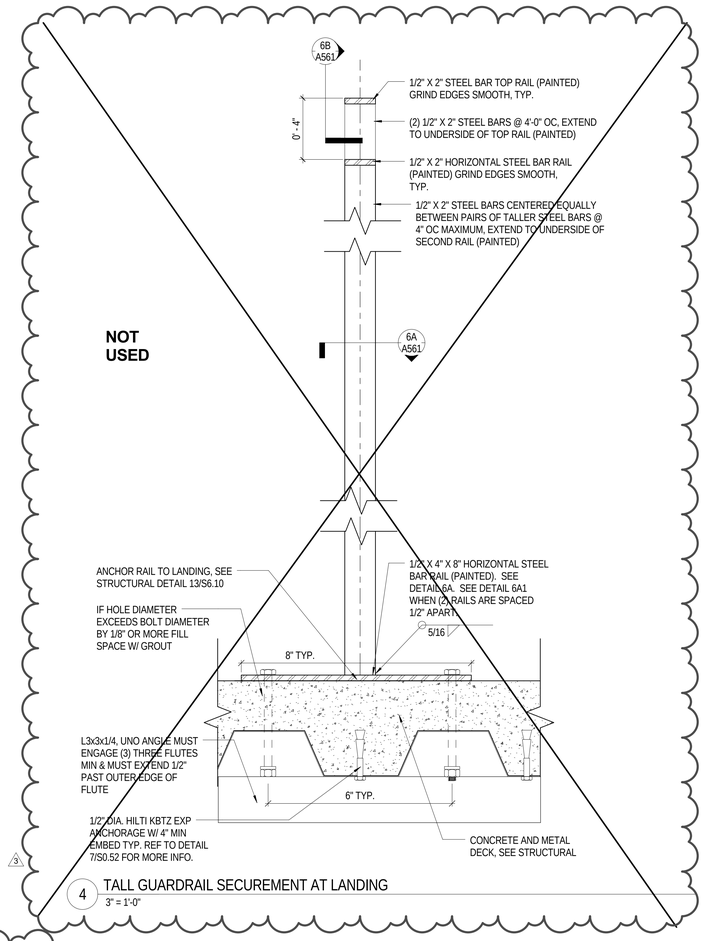
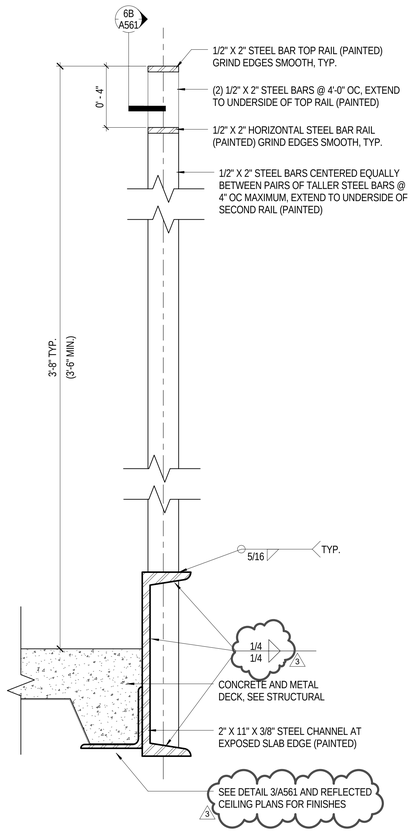
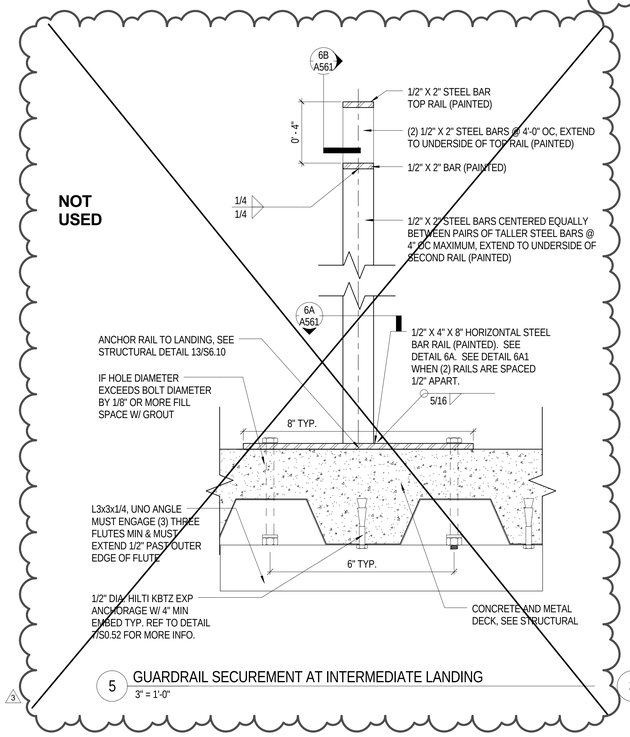




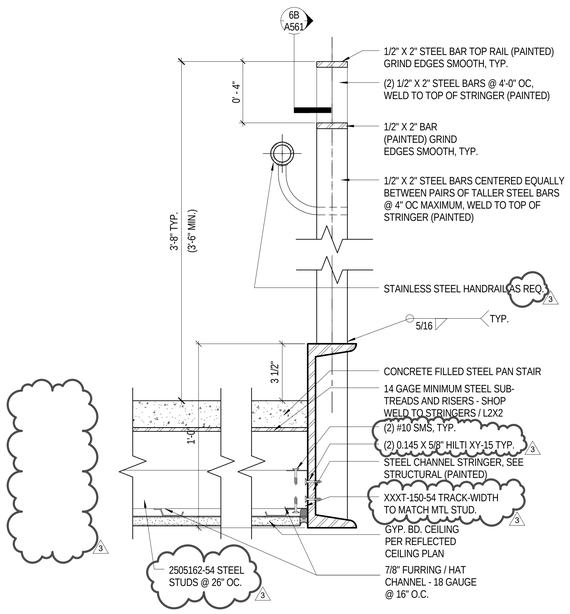
4 TALL GUARDRAIL SECUREMENT AT LANDING
3" = 1'-0"



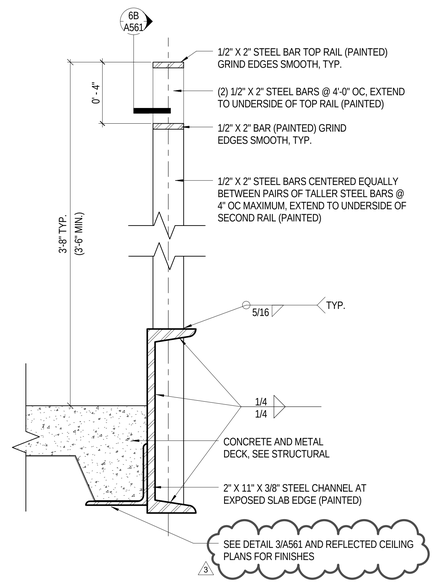
2 TALL GUARDRAIL SECUREMENT AT INTERIOR LANDING
3" = 1'-0"



5 GUARDRAIL SECUREMENT AT INTERMEDIATE LANDING
3" = 1'-0"



3 GUARDRAIL SECUREMENT AT STAIR
3" = 1'-0"



1 GUARDRAIL SECUREMENT AT EXTERIOR LANDING
3" = 1'-0"

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JAMES G. MATSON — No. C13036 — LICENSED ARCHITECT — EXPIRATION 31-JULY-2019 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

STAIR # 3 AND LOBBY GUARDRAIL DETAILS

DATE: JULY 06, 2017

A561

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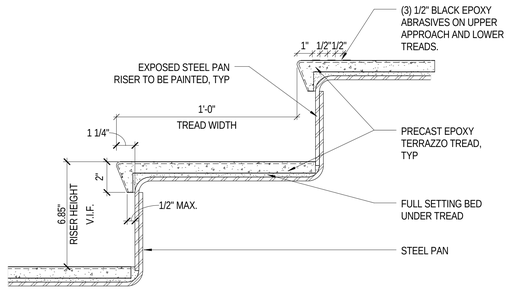
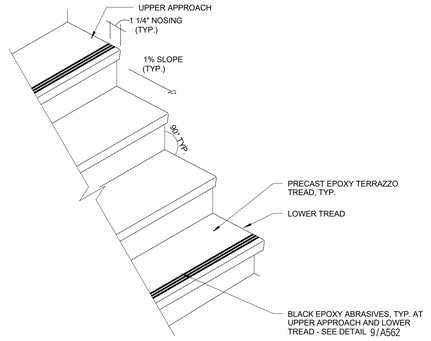
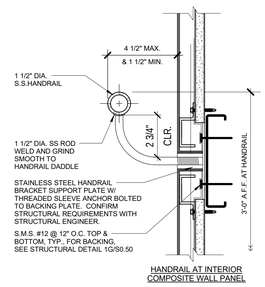
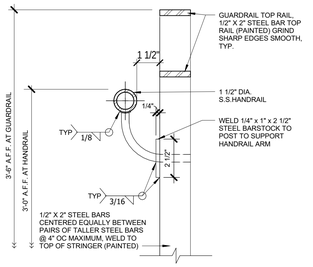


9 TYP TERRAZZO TREAD DETAILS
3" = 1'-0"

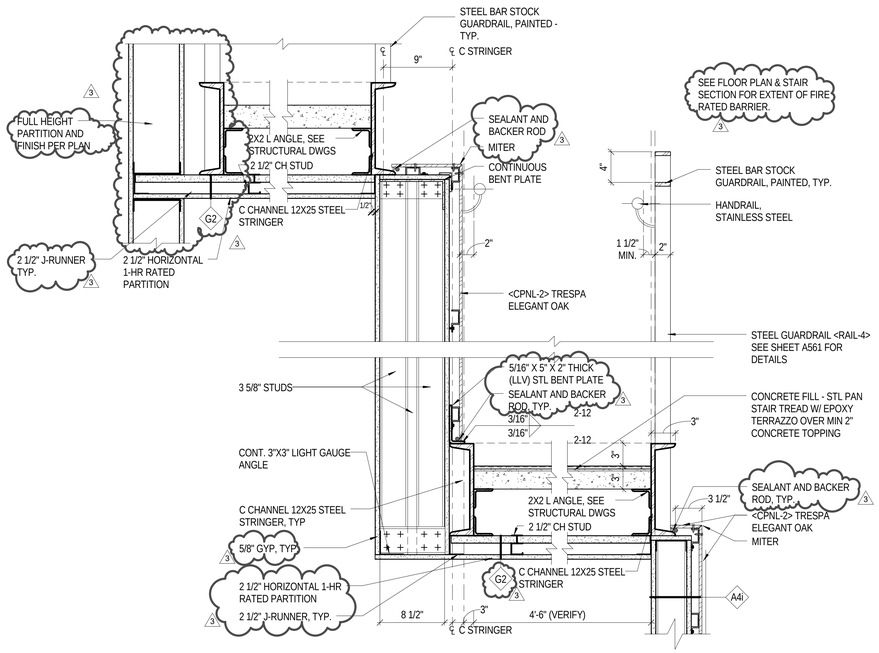




HANDRAIL AT INTERIOR COMPOSITE WALL PANEL

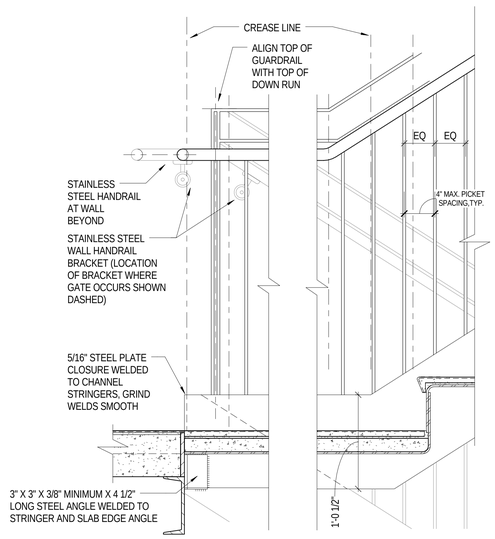


STAIR HANDRAIL AT GUARDRAIL



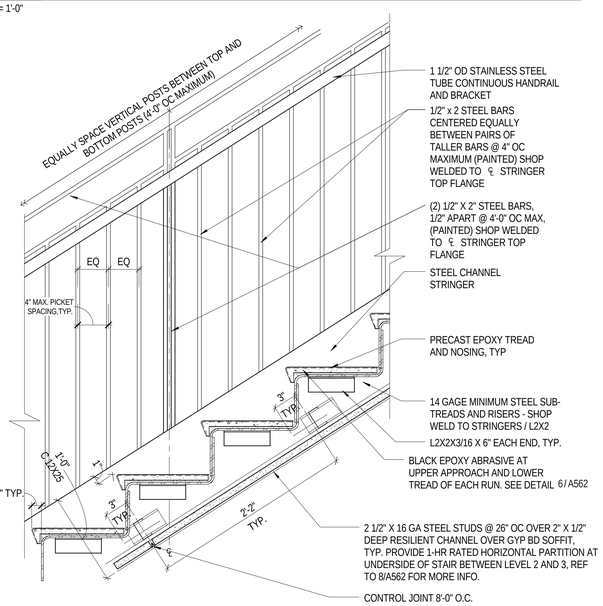
8 STAIR #3 GUARDRAIL SECTION AT TOP LANDING
1 1/2" = 1'-0"

6 CONTRASTING STRIPE @ INTERIOR TERRAZZO STAIRS
1/2" = 1'-0"

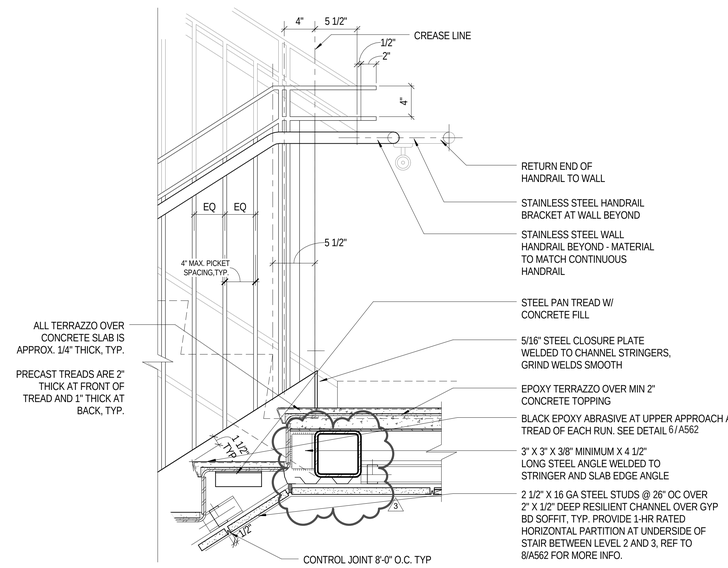


5 STAIR #3 SECTION AT OFFSET FLOOR LANDING
1 1/2" = 1'-0"

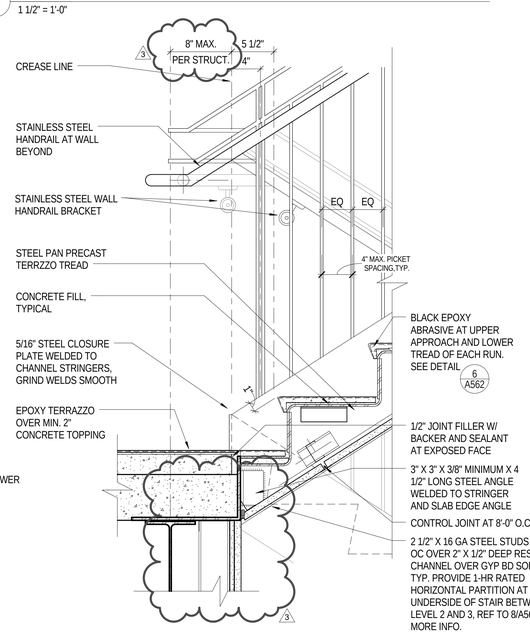
3 STAIR #3 HANDRAIL ATTACHMENT
3" = 1'-0"



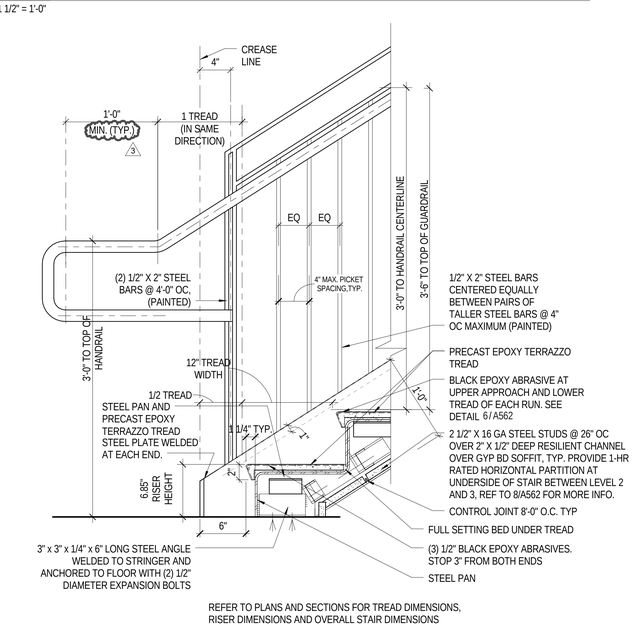
2 STAIR SECTION AT INTERMEDIATE POST
1 1/2" = 1'-0"



7 STAIR #3 SECTION AT INTERMEDIATE LANDING
1 1/2" = 1'-0"



4 STAIR #3 SECTION AT FLOOR LANDING
1 1/2" = 1'-0"



REFER TO PLANS AND SECTIONS FOR TREAD DIMENSIONS, RISER DIMENSIONS AND OVERALL STAIR DIMENSIONS

1 STAIR SECTION AT BOTTOM FLOOR LANDING
1 1/2" = 1'-0"

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REGISTERED ARCHITECT JAMES G. MATSON C13035 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13035

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: TE

HGA NO: 3584-001-00

STAIR DETAILS - STAIR #3

DATE: JULY 06, 2017

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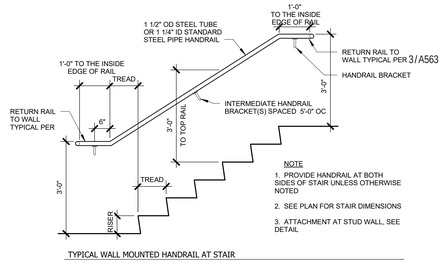
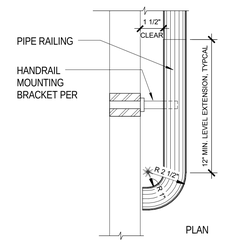
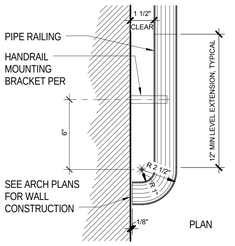


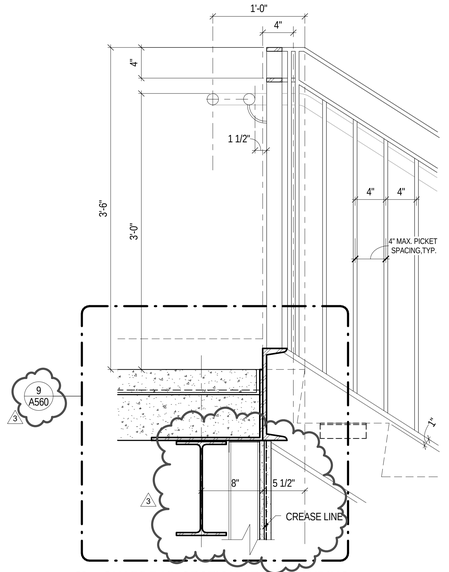
7 HANDRAILS - WALL MOUNTED
1/2" = 1'-0"



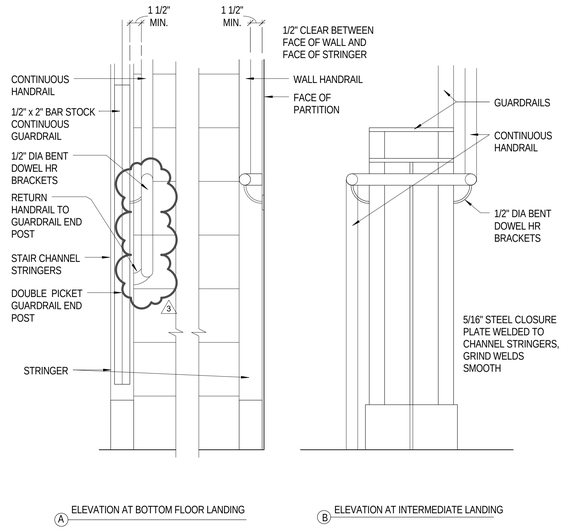
4 HANDRAIL RETURN AT GUARDRAIL
3" = 1'-0"



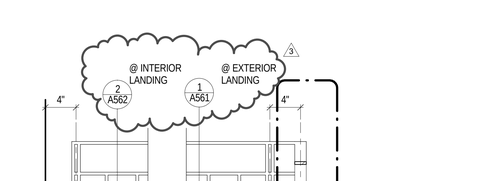
3 HANDRAIL RETURN AT WALL
3" = 1'-0"



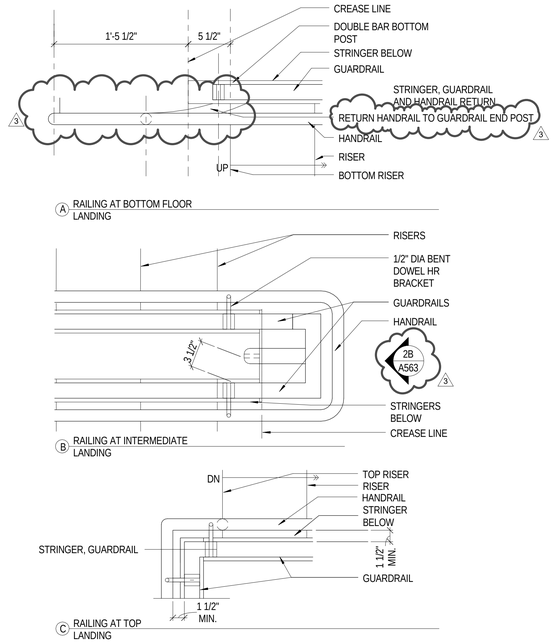
6 GUARDRAIL SECTION AT TOP LANDING
1 1/2" = 1'-0"



2 RAILING ELEVATIONS- TYPE C
1 1/2" = 1'-0"



5 GUARDRAIL AT TOP LANDING
1 1/2" = 1'-0"



1 RAILING PLAN DETAILS
1 1/2" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON No. C13036 RENEWAL DATE SEPTEMBER 30, 2019 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: RE | REVIEW BY: Approver

HGA NO: 3584-001-00

STAIR DETAILS - TYP

DATE: JULY 06, 2017

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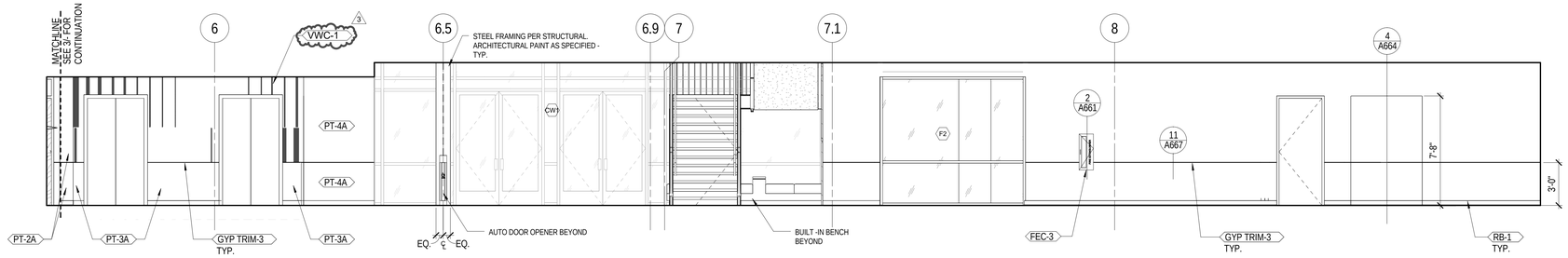
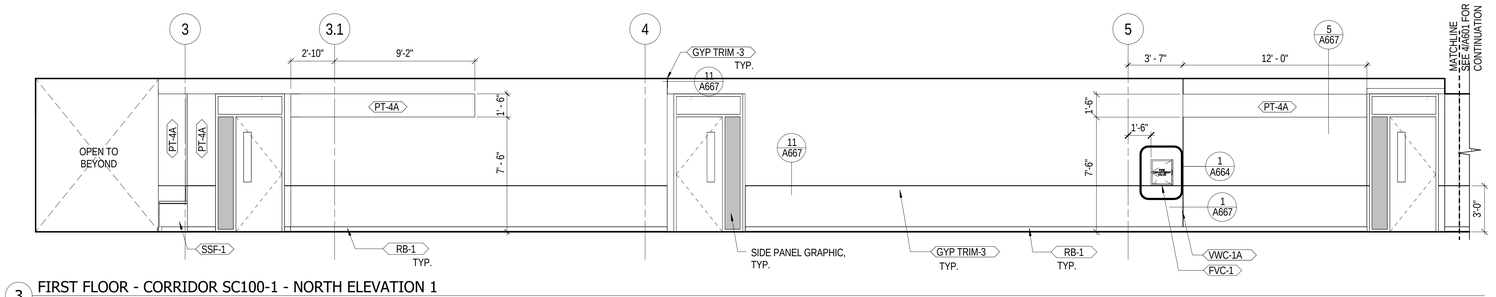
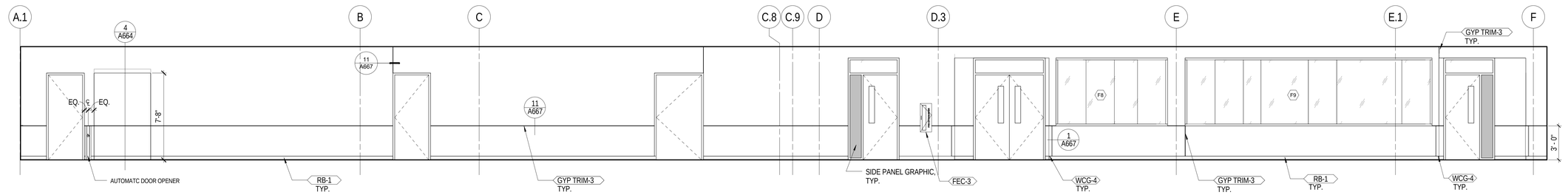


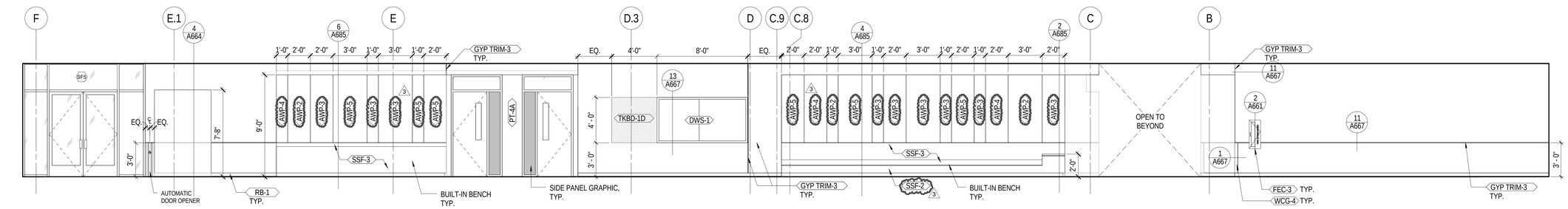
4 FIRST FLOOR - CORRIDOR SC100-1 - NORTH ELEVATION 2
1/4" = 1'-0"



3 FIRST FLOOR - CORRIDOR SC100-1 - NORTH ELEVATION 1
1/4" = 1'-0"



2 FIRST FLOOR - CORRIDOR SC100 - WEST ELEVATION
1/4" = 1'-0"



1 FIRST FLOOR - CORRIDOR SC100 - EAST ELEVATION
1/4" = 1'-0"

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR ELEVATIONS - FIRST LEVEL

DATE: JULY 06, 2017

A601

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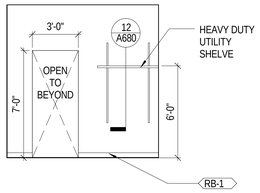
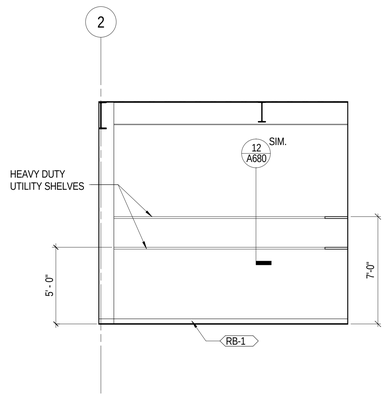
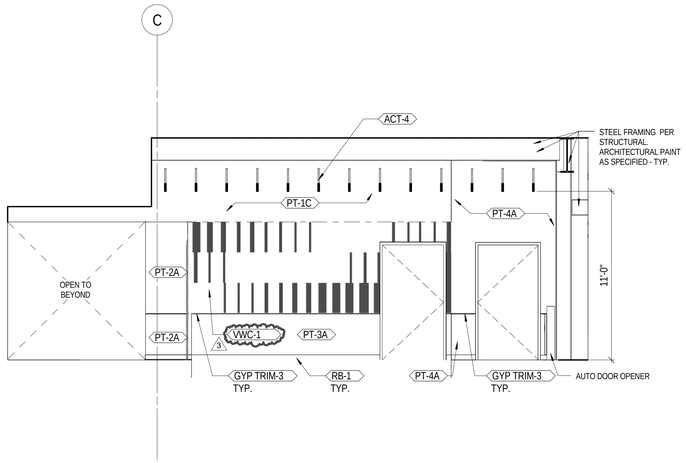


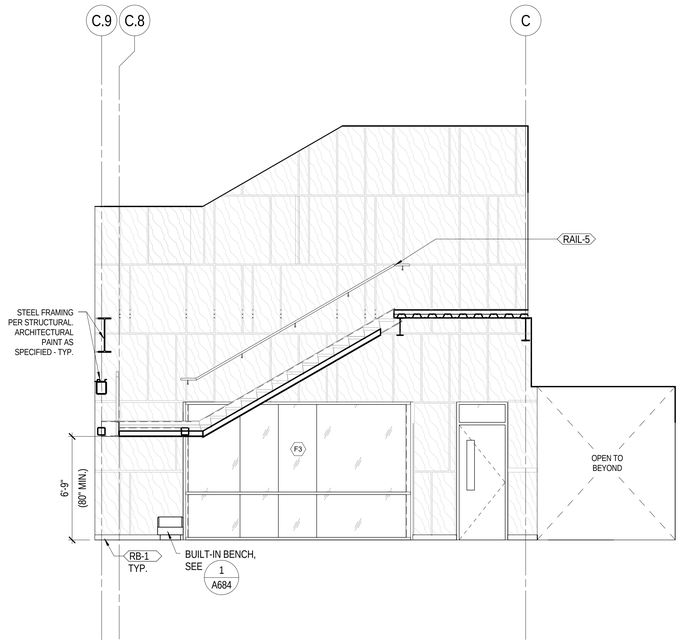
3
7 FIRST FLOOR - DIVISION OFFICE ARCHIVE - WEST ELEVATION
1/4" = 1'-0"



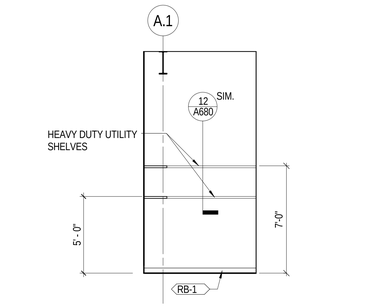
3
6 FIRST FLOOR - STORAGE SC124 - SOUTH ELEVATION
1/4" = 1'-0"



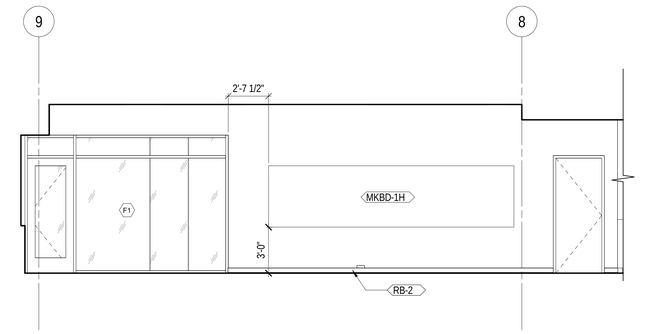
4 FIRST FLOOR - LOBBY SC105 - WEST ELEVATION
1/4" = 1'-0"



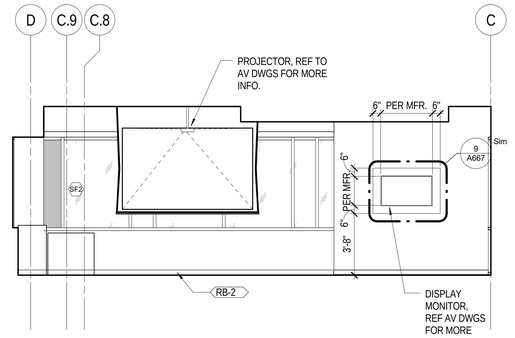
3 FIRST FLOOR - LOBBY SC105 - EAST ELEVATION
1/4" = 1'-0"



3
5 FIRST FLOOR - STORAGE SC124 - WEST ELEVATION
1/4" = 1'-0"



2 FIRST FLOOR - SCIENCE LEARNING CENTER SC103 - SOUTH ELEVATION
1/4" = 1'-0"



1 FIRST FLOOR - SCIENCE LEARNING CENTER SC103 - EAST ELEVATION
1/4" = 1'-0"

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DISTRICT

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COLLEGE

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JAMES G. MATSON
LICENSED ARCHITECT
No. C13036
EXPIRATION: 08-31-2019
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR ELEVATIONS - FIRST LEVEL

DATE: JULY 06, 2017

A603

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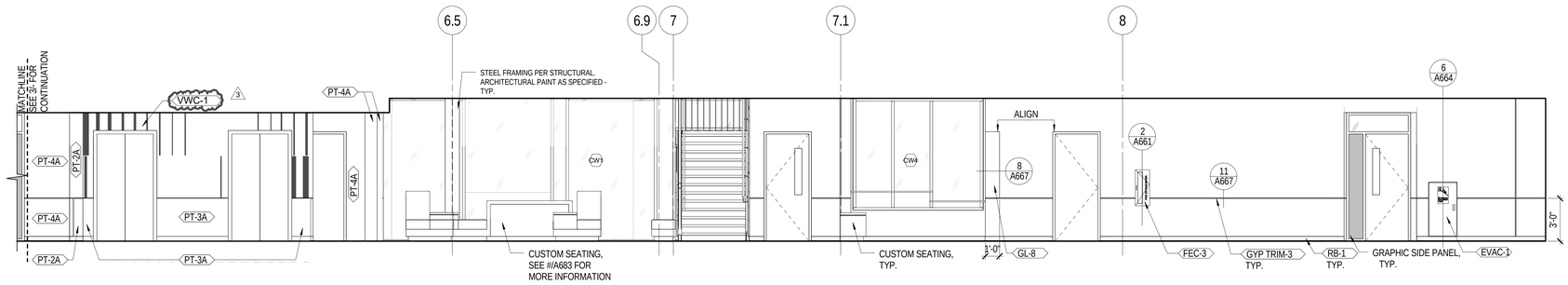
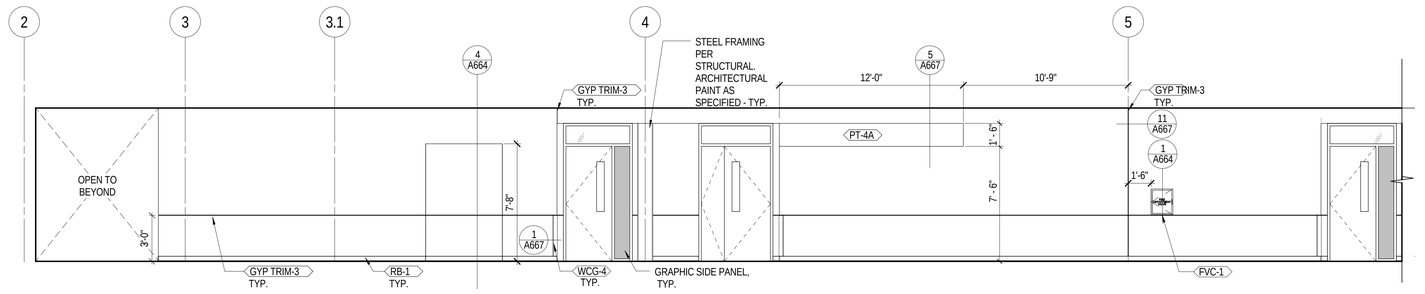
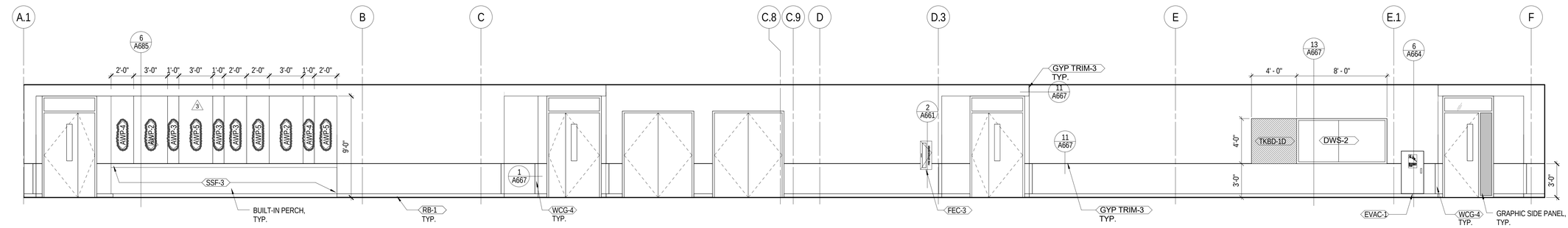


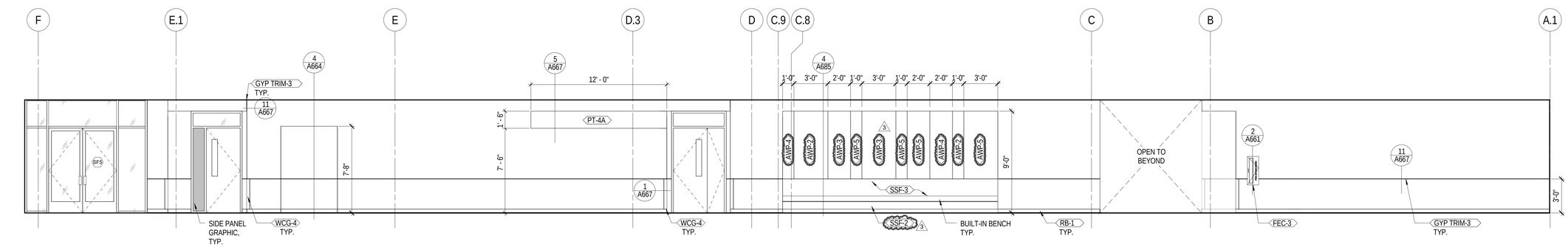
4 SECOND FLOOR - CORRIDOR SC200-1 - NORTH ELEVATION 2
1/4" = 1'-0"



3 SECOND FLOOR - CORRIDOR SC200-1 - NORTH ELEVATION 1
1/4" = 1'-0"



2 SECOND FLOOR - CORRIDOR SC200 - WEST ELEVATION
1/4" = 1'-0"



1 SECOND FLOOR - CORRIDOR SC200 - EAST ELEVATION
1/4" = 1'-0"

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR ELEVATIONS - SECOND LEVEL

DATE: JULY 06, 2017

A604

ADDENDA PACKAGE

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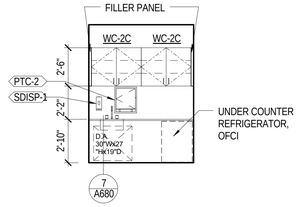
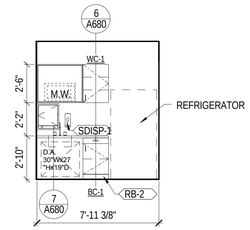
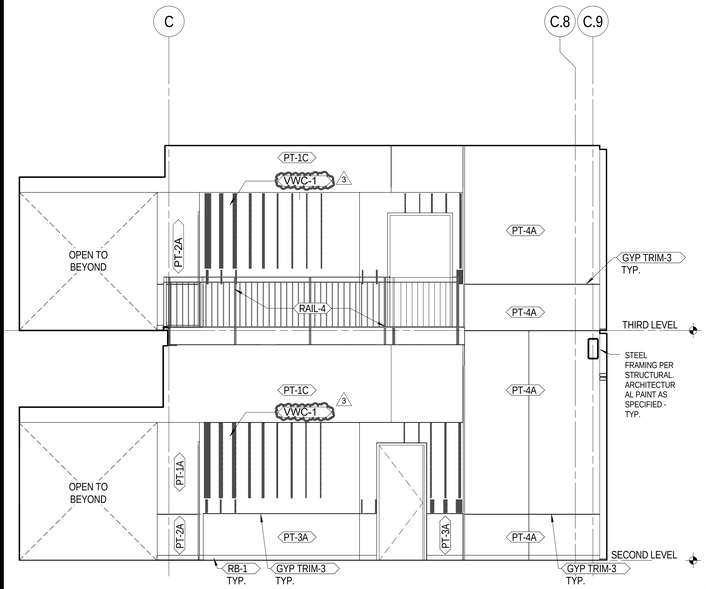


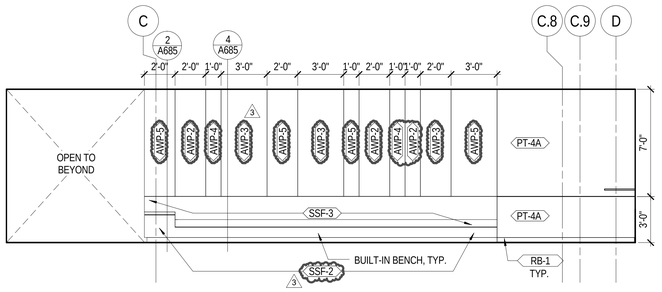
9 SECOND FLOOR STAFF ROOM SC209 - WEST ELEVATION
1/4" = 1'-0"



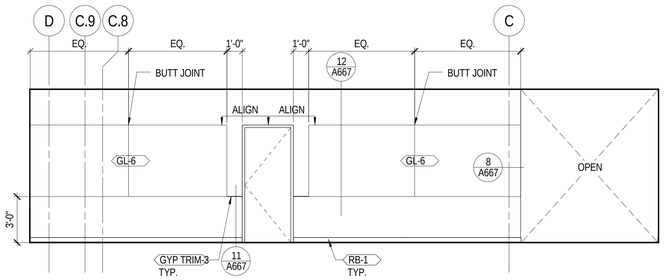
SECOND FLOOR VESTIBULE SC201-8 - SOUTH ELEVATION
5 1/4" = 1'-0"



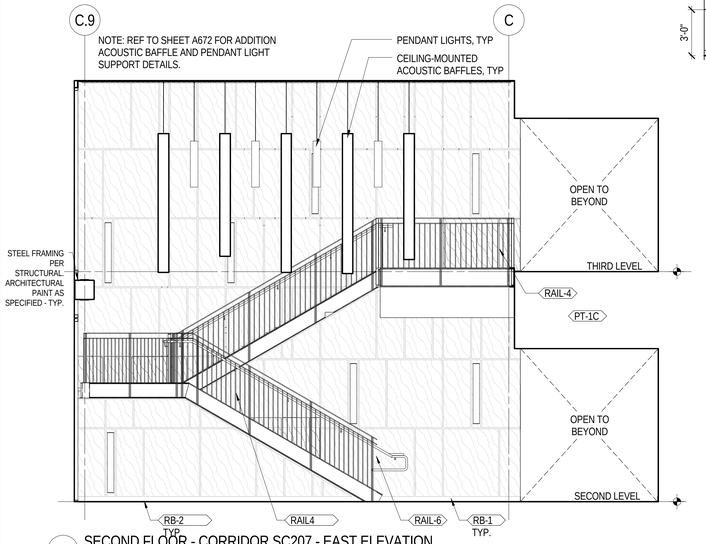
8 SECOND FLOOR - CORRIDOR SC207 - WEST ELEVATION
1/4" = 1'-0"



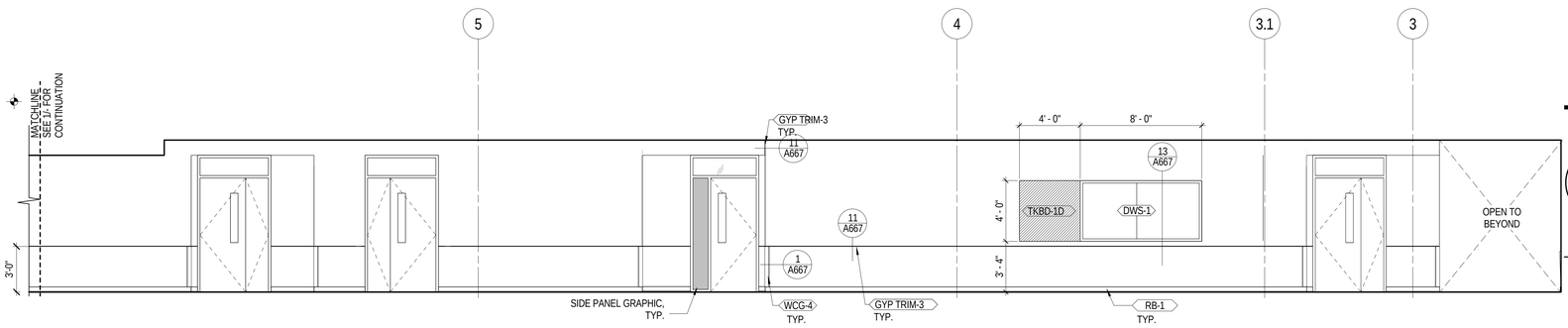
6 SECOND FLOOR - CORRIDOR SC205 - WEST ELEVATION
1/4" = 1'-0"



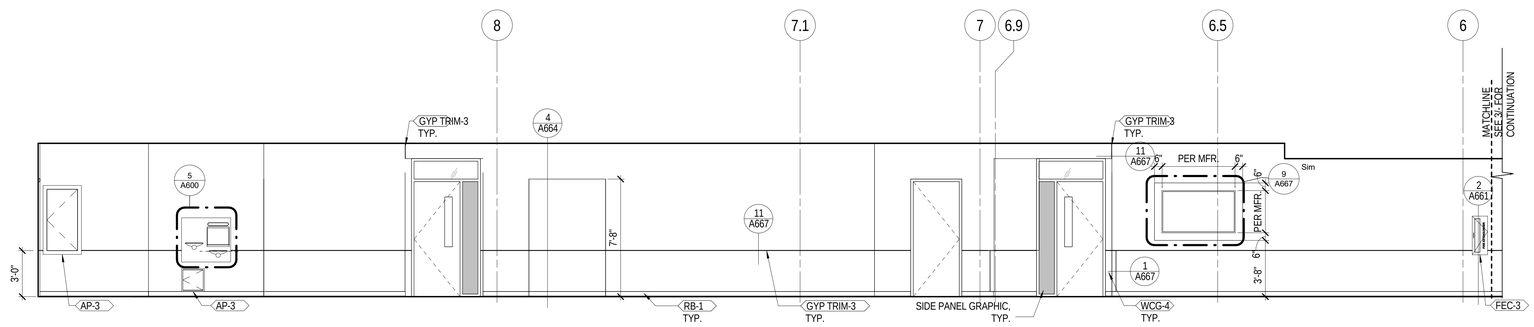
3 SECOND FLOOR - CORRIDOR SC205 - EASTELEVATION
1/4" = 1'-0"



7 SECOND FLOOR - CORRIDOR SC207 - EAST ELEVATION
1/4" = 1'-0"



2 SECOND FLOOR - CORRIDOR SC200-1 - SOUTH ELEVATION 2
1/4" = 1'-0"



1 SECOND FLOOR - CORRIDOR SC200-1 - SOUTH ELEVATION 1
1/4" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON REGISTERED PROFESSIONAL ENGINEER SEPTEMBER 30, 2015 CIVIL STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR ELEVATIONS - SECOND LEVEL

DATE: JULY 06, 2017

A605

ADDENDA PACKAGE

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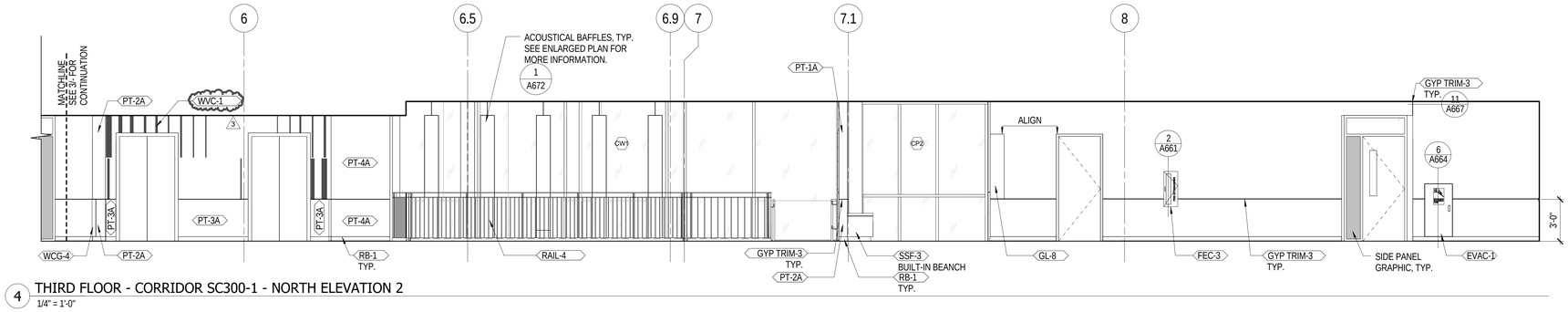
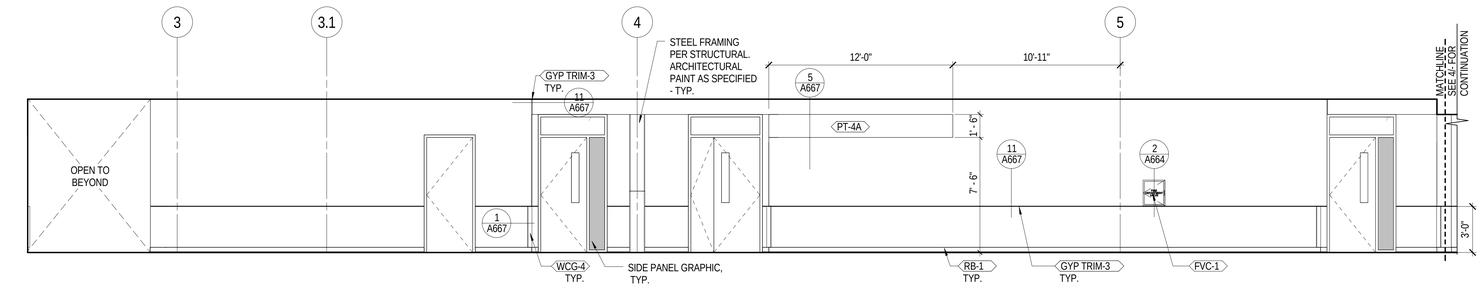
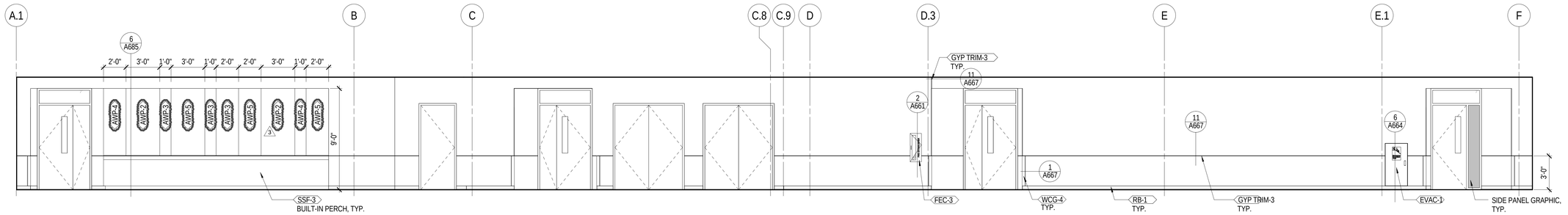


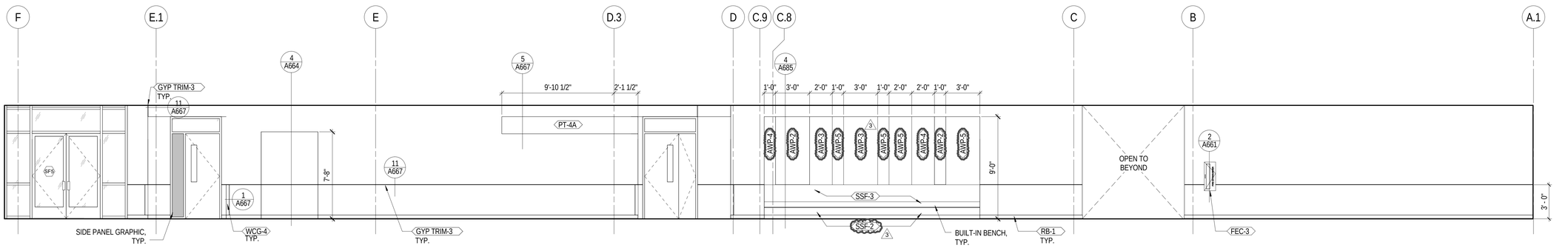
4 THIRD FLOOR - CORRIDOR SC300-1 - NORTH ELEVATION 2
1/4" = 1'-0"



3 THIRD FLOOR - CORRIDOR SC300-1 - NORTH ELEVATION 1
1/4" = 1'-0"



2 THIRD FLOOR - CORRIDOR SC300 - WEST ELEVATION
1/4" = 1'-0"



1 THIRD FLOOR - CORRIDOR SC300 - EAST ELEVATION
1/4" = 1'-0"

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JAMES G. MATSON — LICENSED ARCHITECT — No. C13036 — REGISTERED PROFESSIONAL ENGINEER — SEPTEMBER 30, 2019 — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR ELEVATIONS - THIRD LEVEL

DATE: JULY 06, 2017

A606

ADDENDA PACKAGE

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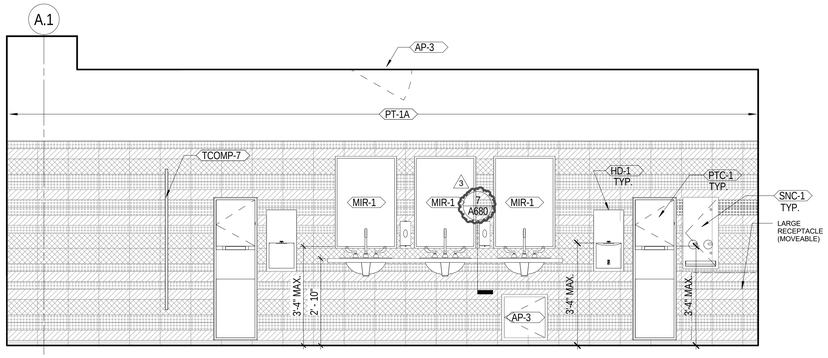
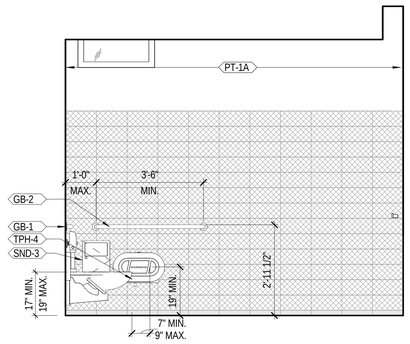
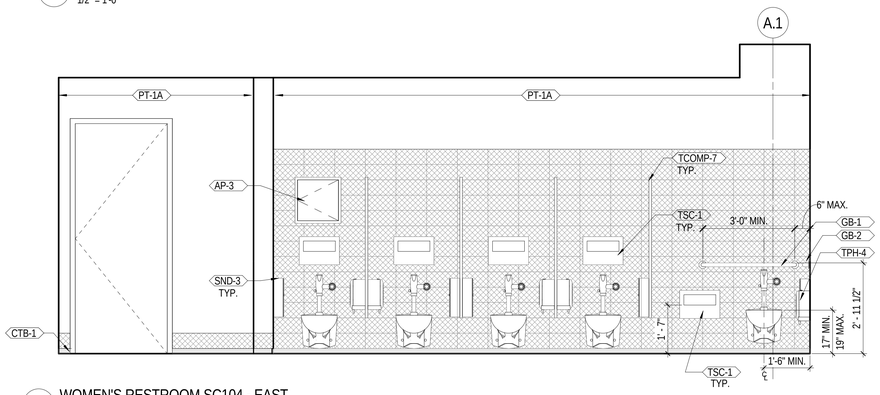
MS



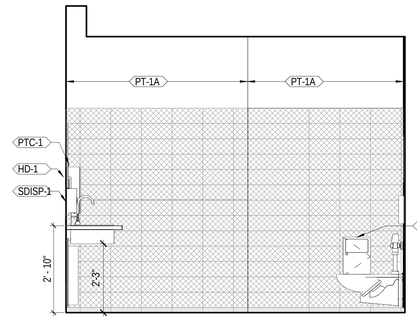
9 WOMEN'S RESTROOM SC104 - WEST
1/2" = 1'-0"



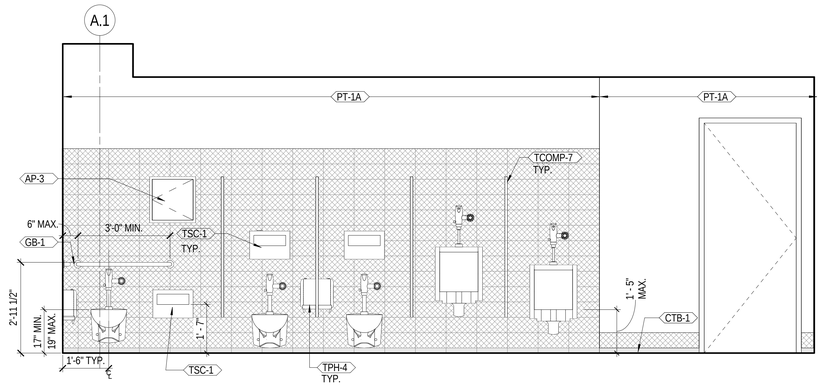
8 WOMEN'S RESTROOM SC104 - SOUTH
1/2" = 1'-0"



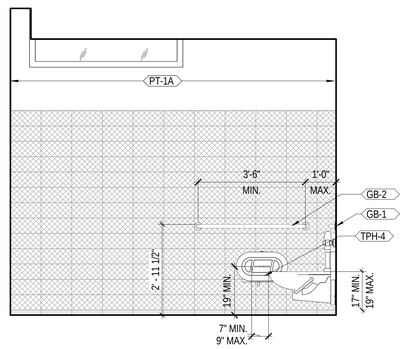
7 WOMEN'S RESTROOM SC104 - EAST
1/2" = 1'-0"



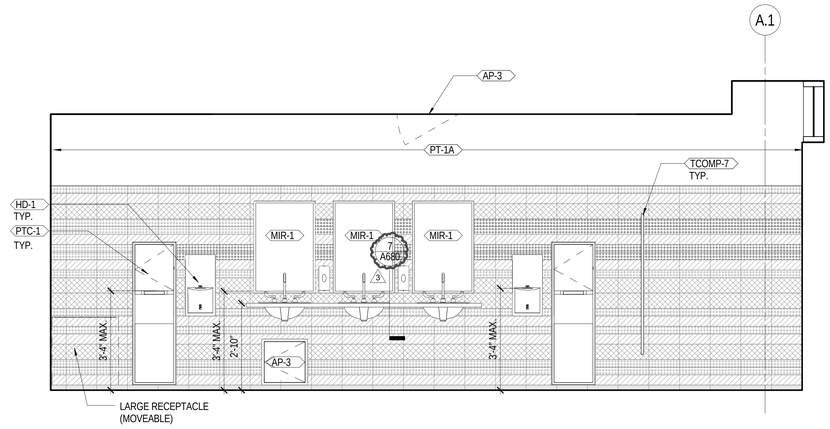
6 WOMEN'S RESTROOM SC104 - NORTH
1/2" = 1'-0"



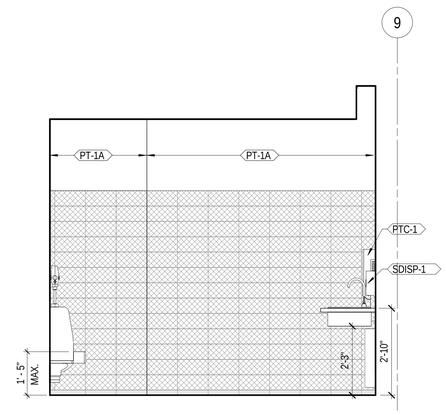
5 MEN'S RESTROOM SC102 - WEST
1/2" = 1'-0"



4 MEN'S RESTROOM SC102 - SOUTH
1/2" = 1'-0"



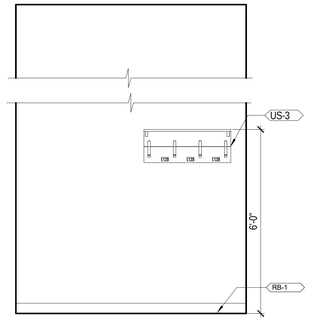
3 MEN'S RESTROOM SC102 - EAST
1/2" = 1'-0"



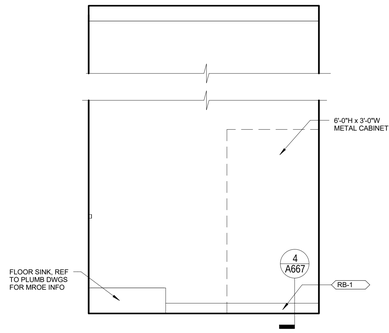
2 MEN'S RESTROOM SC102 - NORTH
1/2" = 1'-0"

LEGEND - RESTROOM TILE

- CTW-3 — 6"x12" CERAMIC WALL TILE
- CTW-2 — 4"x12" CERAMIC WALL TILE
- CTW-1 — 3"x12" CERAMIC WALL TILE
- CTB-1 — 2"x12" CERAMIC TILE BASE



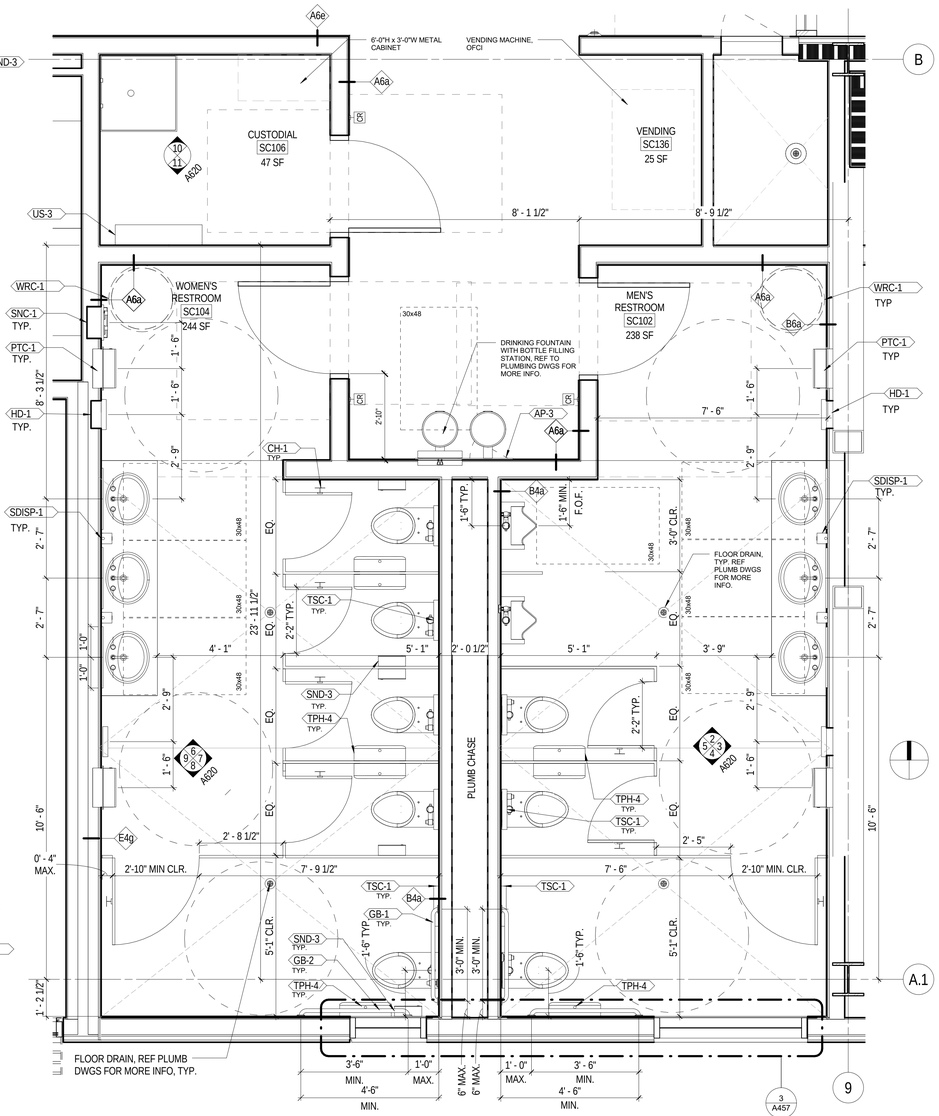
11 TYP CUSTODIAL SC - SOUTH
1/2" = 1'-0"



10 TYP CUSTODIAL SC - NORTH
1/2" = 1'-0"

GENERAL NOTES

A. SEE SHEET A600 FOR TYPICAL MOUNTING HEIGHTS.
B. SEE SLAB PLANS FOR MORE DIMENSIONS
C. FOR CLEARANCE AT LAVATORY, SEE 4/A600
D. FOR GRAB BAR DETAIL, SEE 11/A600
E. SEE FINISH PLANS A221, A222, A223 AND FINISH SCHEDULE A090.
F. SEE 9/A600 FOR FOR HAND DRYER DIAGRAM.
G. MAINTAIN MIN. 1% AND MAX. 2% FLOOR SLOPE TO FLOOR DRAIN.
H. PROVIDE PROTECTIVE COVER FOR ALL EXPOSED PIPES UNDER LAVATORIES.
I. SEE A011 FOR MATERIAL ID INDEX.
J. PROVIDE ONE COAT HOOK <CH-1> BEHIND THE STALL DOOR IN EVERY STALL INSIDE RESTROOMS SC102, SC104, SC202, SC204, SC302, AND SC304.
K. ALL TILE TO TERMINATE AT THE SAME HEIGHT. EXPOSED EDGES OF TILE TO BE CAPPED WITH METAL TRIM <CTA-1>.
L. PARTITIONS INSIDE ALL RESTROOMS TO USE WATER-RESISTANT GYP BOARD.
M. TILE GROUT FOR FLOOR TILE AND WALL TILE TO BE <GR-1>



1 ENLARGED MEN'S RESTROOM SC102 AND WOMEN'S RESTROOM SC104
1/2" = 1'-0"

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1918 Main Street, Third Floor
Santa Monica, California 90405
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1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA

LICENSED ARCHITECT JAMES G. MATSON No. 18,379 REGISTERED PROFESSIONAL ENGINEER SEPTEMBER 30, 2019 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: Approver

HGA NO: 3584-001-00

ENLARGED TOILET PLANS AND ELEVATIONS - LEVEL 1

DATE: JULY 06, 2017

A620

ADDENDA PACKAGE

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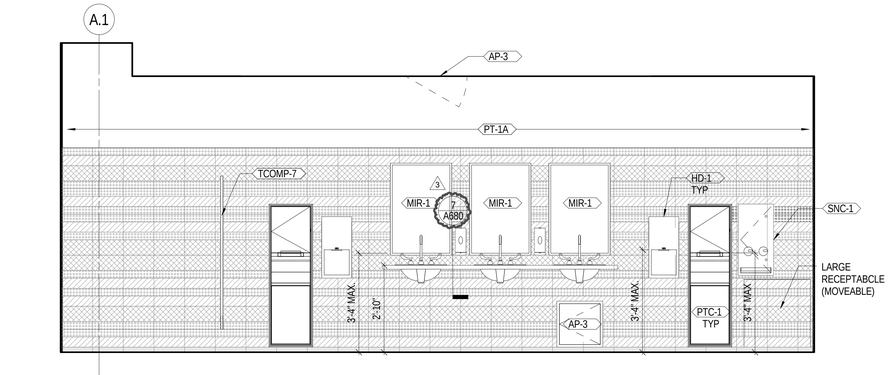
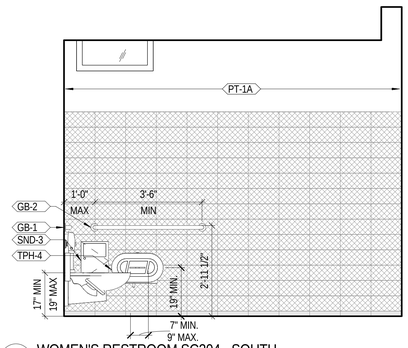
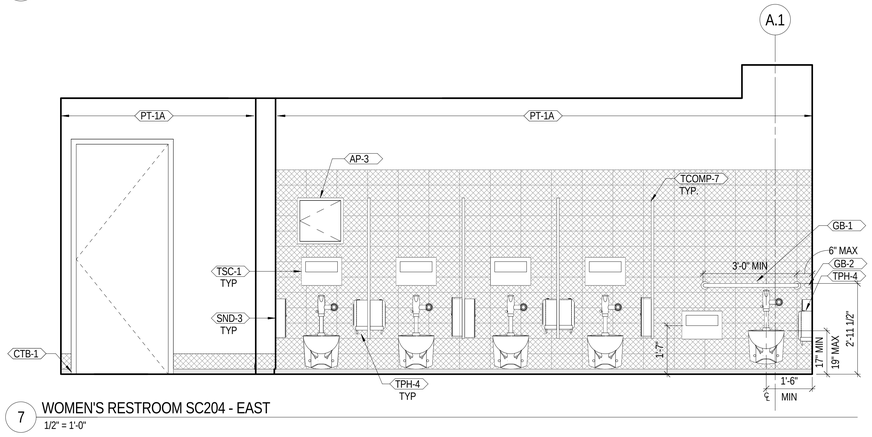


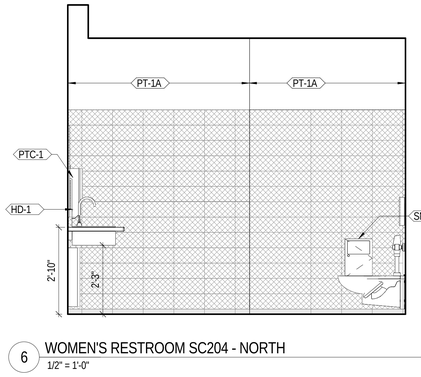
9 WOMEN'S RESTROOM SC204 - WEST
1/2" = 1'-0"



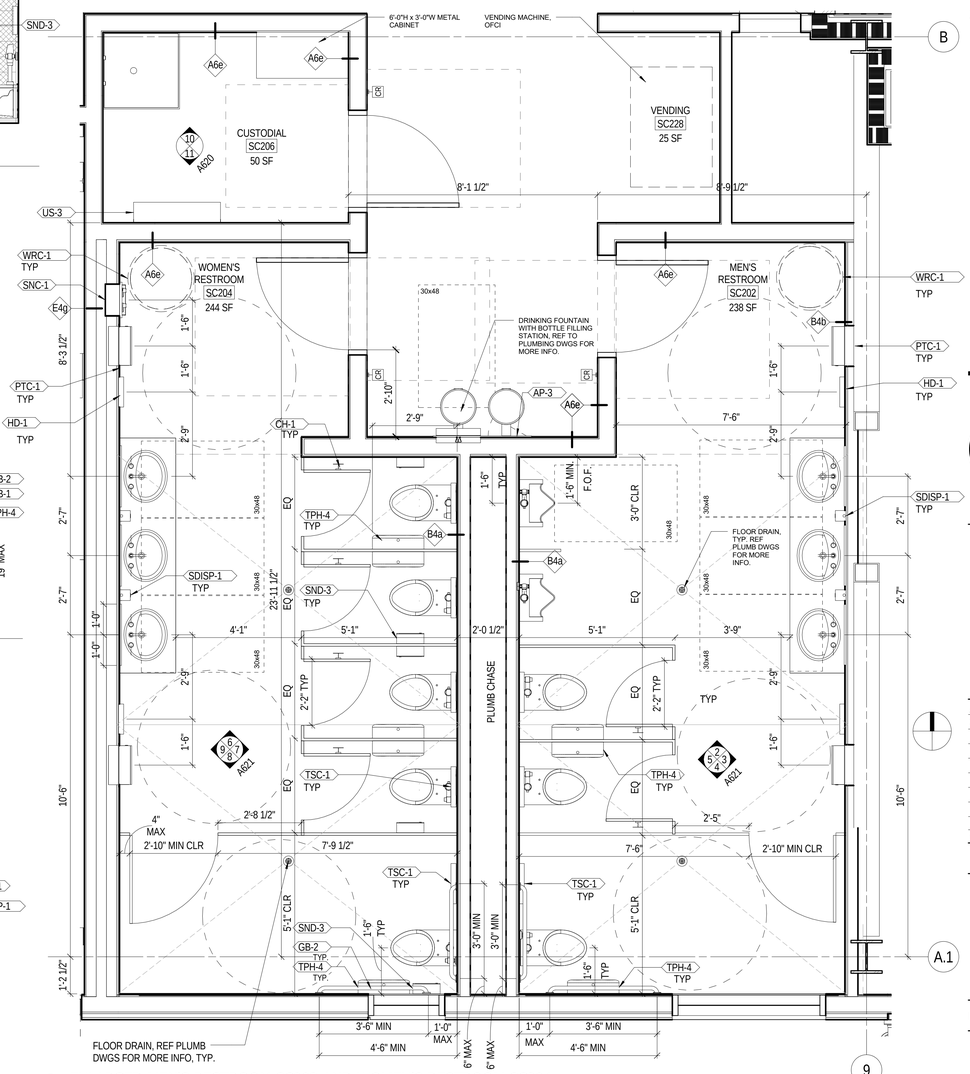
8 WOMEN'S RESTROOM SC204 - SOUTH
1/2" = 1'-0"



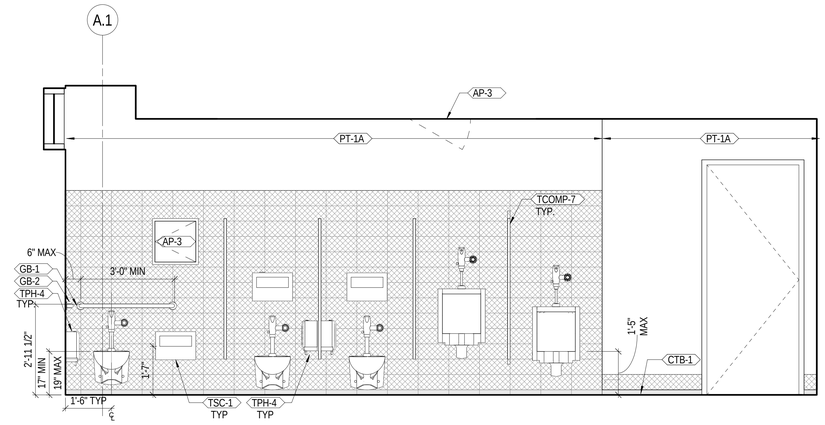
7 WOMEN'S RESTROOM SC204 - EAST
1/2" = 1'-0"



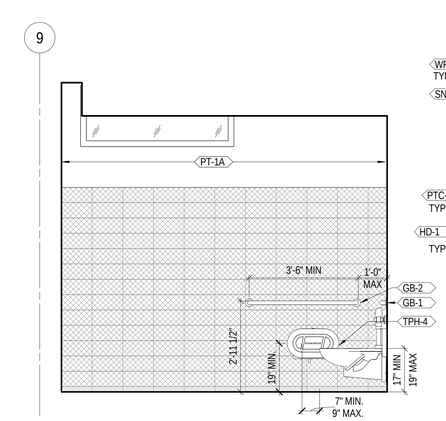
6 WOMEN'S RESTROOM SC204 - NORTH
1/2" = 1'-0"



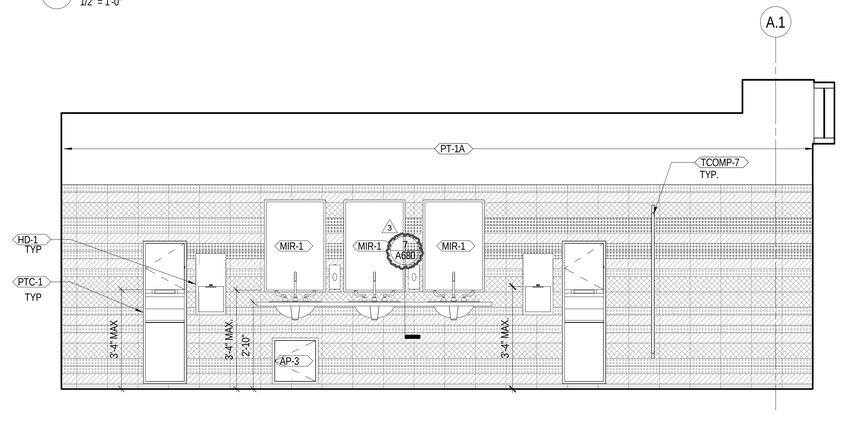
1 ENLARGED MEN'S RESTROOM SC202 AND WOMEN'S RESTROOM SC204
1/2" = 1'-0"



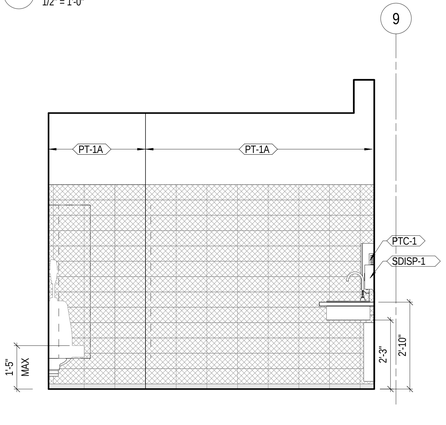
5 MEN'S RESTROOM SC202 - WEST
1/2" = 1'-0"



4 MEN'S RESTROOM SC202 - SOUTH
1/2" = 1'-0"



3 MEN'S RESTROOM SC202 - EAST
1/2" = 1'-0"



2 MEN'S RESTROOM SC202 - NORTH
1/2" = 1'-0"

LEGEND - RESTROOM TILE

- CTW-3 — 6"x12" CERAMIC WALL TILE
- CTW-2 — 4"x12" CERAMIC WALL TILE
- CTW-1 — 3"x12" CERAMIC WALL TILE
- CTB-1 — 2"x12" CERAMIC TILE BASE

GENERAL NOTES

A. SEE SHEET A600 FOR TYPICAL MOUNTING HEIGHTS.
B. SEE SLAB PLANS FOR MORE DIMENSIONS
C. FOR CLEARANCE AT LAVATORY, SEE 4/A600
D. FOR GRAB BAR DETAIL, SEE 11/A600
E. SEE FINISH PLANS A221, A222, A223 AND FINISH SCHEDULE A090.
F. SEE 9/A600 FOR FOR HAND DRYER DIAGRAM.
G. MAINTAIN MIN. 1% AND MAX. 2% FLOOR SLOPE TO FLOOR DRAIN.
H. PROVIDE PROTECTIVE COVER FOR ALL EXPOSED PIPES UNDER LAVATORIES.
I. SEE A011 FOR MATERIAL ID INDEX.
J. PROVIDE ONE COAT HOOK <CH-1> BEHIND THE STALL DOOR IN EVERY STALL INSIDE RESTROOMS SC102, SC104, SC202, SC204, SC302, AND SC304.
K. ALL TILE TO TERMINATE AT THE SAME HEIGHT. EXPOSED EDGES OF TILE TO BE CAPPED WITH METAL TRIM <CTA-1>.
L. PARTITIONS INSIDE ALL RESTROOMS TO USE WATER-RESISTANT GYP BOARD.
M. TILE GROUT FOR FLOOR TILE AND WALL TILE TO BE <GR-1>

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON — No. C13036 — REGISTERED ARCHITECT — SEPTEMBER 30, 2019 RENEWAL DATE — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: Approver

HGA NO: 3584-001-00

ENLARGED TOILET PLANS AND ELEVATIONS - LEVEL 2

DATE: JULY 06, 2017

A621

ADDENDA PACKAGE

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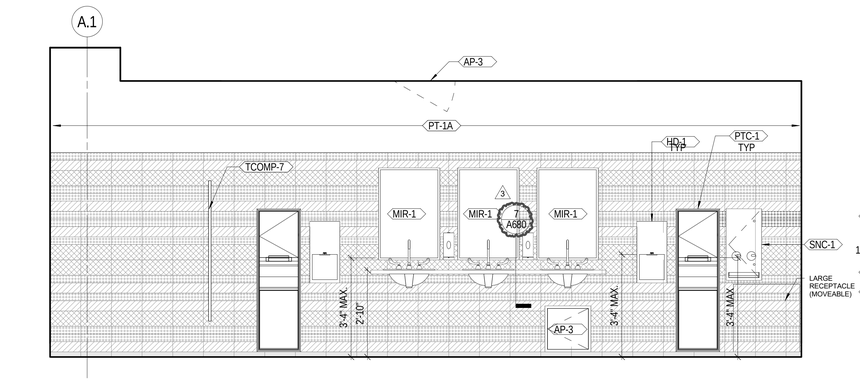
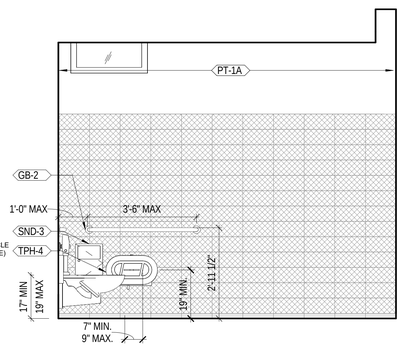
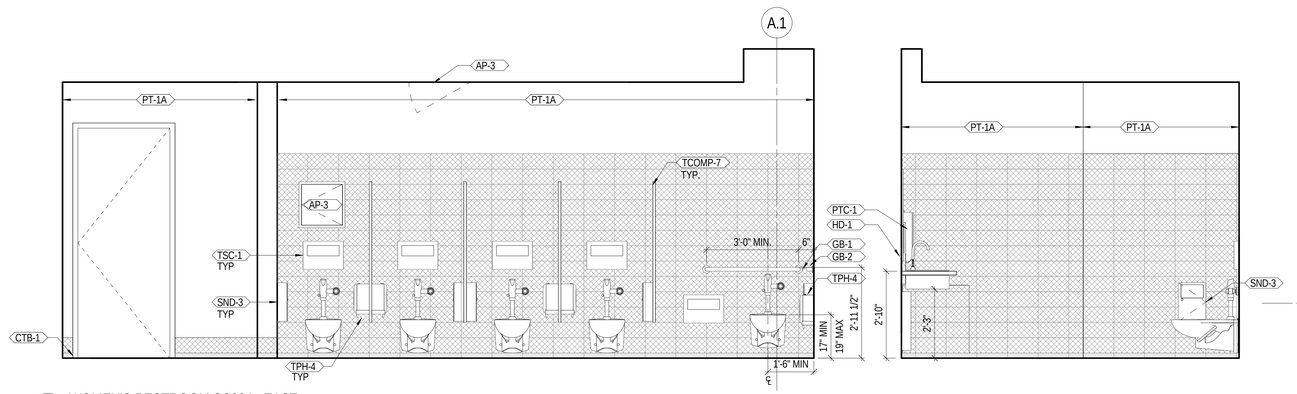


9 WOMEN'S RESTROOM SC304 - WEST
1/2" = 1'-0"

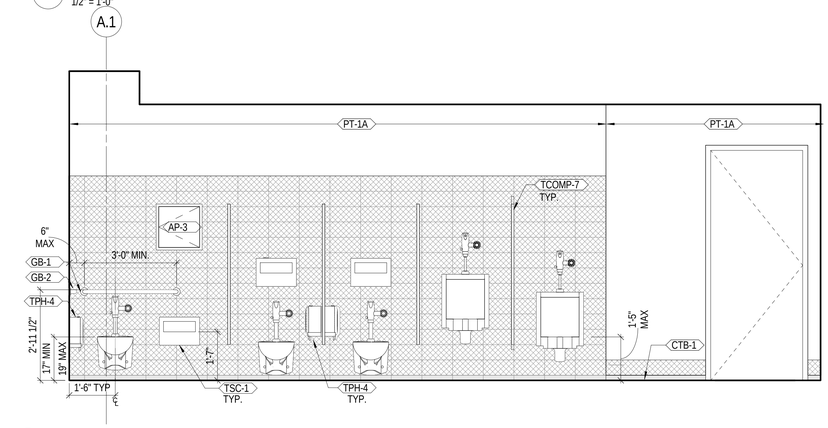


8 WOMEN'S RESTROOM SC304 - SOUTH
1/2" = 1'-0"

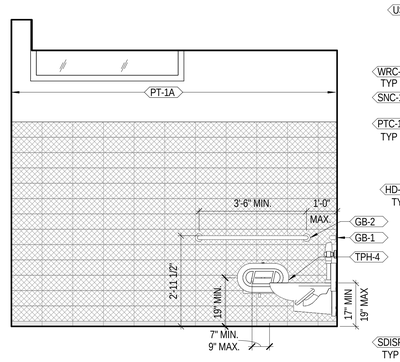


7 WOMEN'S RESTROOM SC304 - EAST
1/2" = 1'-0"

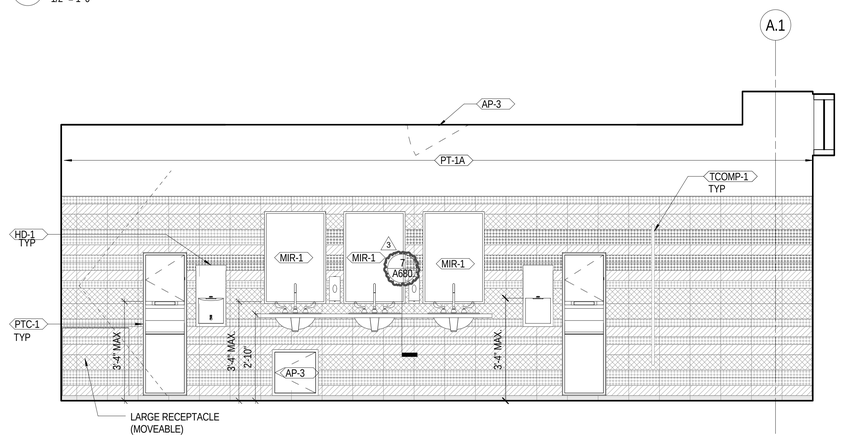
6 WOMEN'S RESTROOM SC304 - NORTH
1/2" = 1'-0"



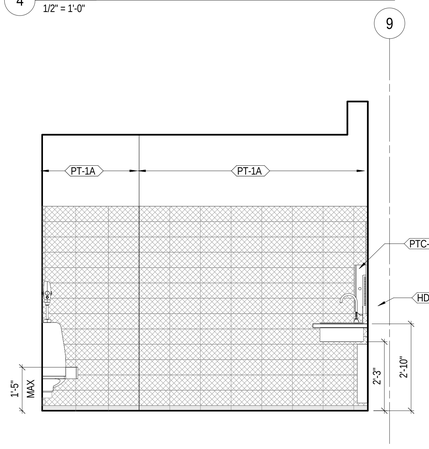
5 MEN'S RESTROOM SC302 - WEST
1/2" = 1'-0"



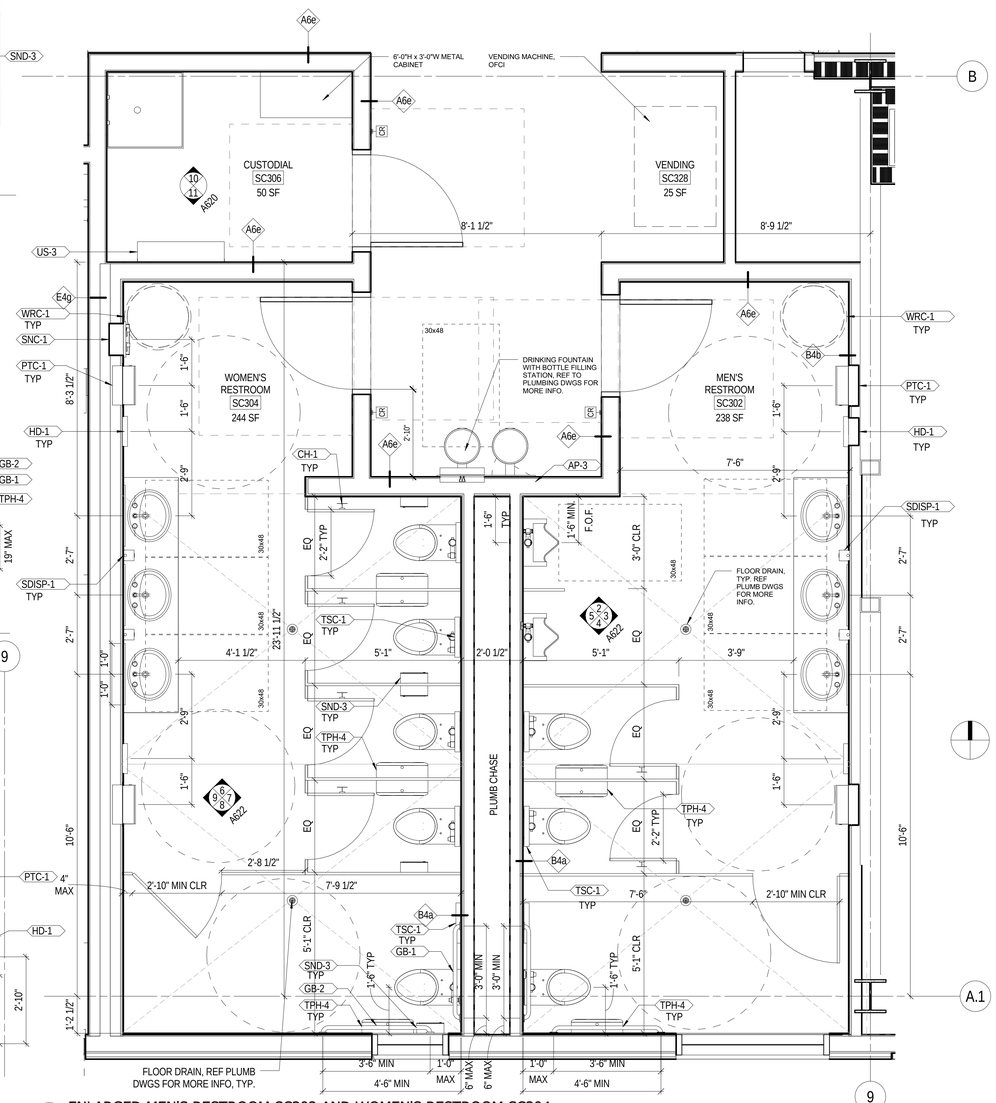
4 MEN'S RESTROOM SC302 - SOUTH
1/2" = 1'-0"



3 MEN'S RESTROOM SC302 - EAST
1/2" = 1'-0"



2 MEN'S RESTROOM SC302 - NORTH
1/2" = 1'-0"



1 ENLARGED MEN'S RESTROOM SC302 AND WOMEN'S RESTROOM SC304
1/2" = 1'-0"

LEGEND - RESTROOM TILE

- CTW-3 — 6"x12" CERAMIC WALL TILE
- CTW-2 — 4"x12" CERAMIC WALL TILE
- CTW-1 — 3"x12" CERAMIC WALL TILE
- CTB-1 — 2"x12" CERAMIC TILE BASE

GENERAL NOTES

A. SEE SHEET A600 FOR TYPICAL MOUNTING HEIGHTS.
B. SEE SLAB PLANS FOR MORE DIMENSIONS
C. FOR CLEARANCE AT LAVATORY, SEE 4/A600
D. FOR GRAB BAR DETAIL, SEE 11/A600
E. SEE FINISH PLANS A221, A222, A223 AND FINISH SCHEDULE A090.
F. SEE 9/A600 FOR FOR HAND DRYER DIAGRAM.
G. MAINTAIN MIN. 1% AND MAX. 2% FLOOR SLOPE TO FLOOR DRAIN.
H. PROVIDE PROTECTIVE COVER FOR ALL EXPOSED PIPES UNDER LAVATORIES.
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L. PARTITIONS INSIDE ALL RESTROOMS TO USE WATER-RESISTANT GYP BOARD.
M. TILE GROUT FOR FLOOR TILE AND WALL TILE TO BE <GR-1>

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LICENSED ARCHITECT JAMES G. MATSON No. 18299 RENEWAL DATE SEPTEMBER 30, 2019 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: SK | REVIEW BY: Approver

HGA NO: 3584-001-00

ENLARGED TOILET PLANS AND ELEVATIONS - LEVEL 3

DATE: JULY 06, 2017

A622
ADDENDA PACKAGE

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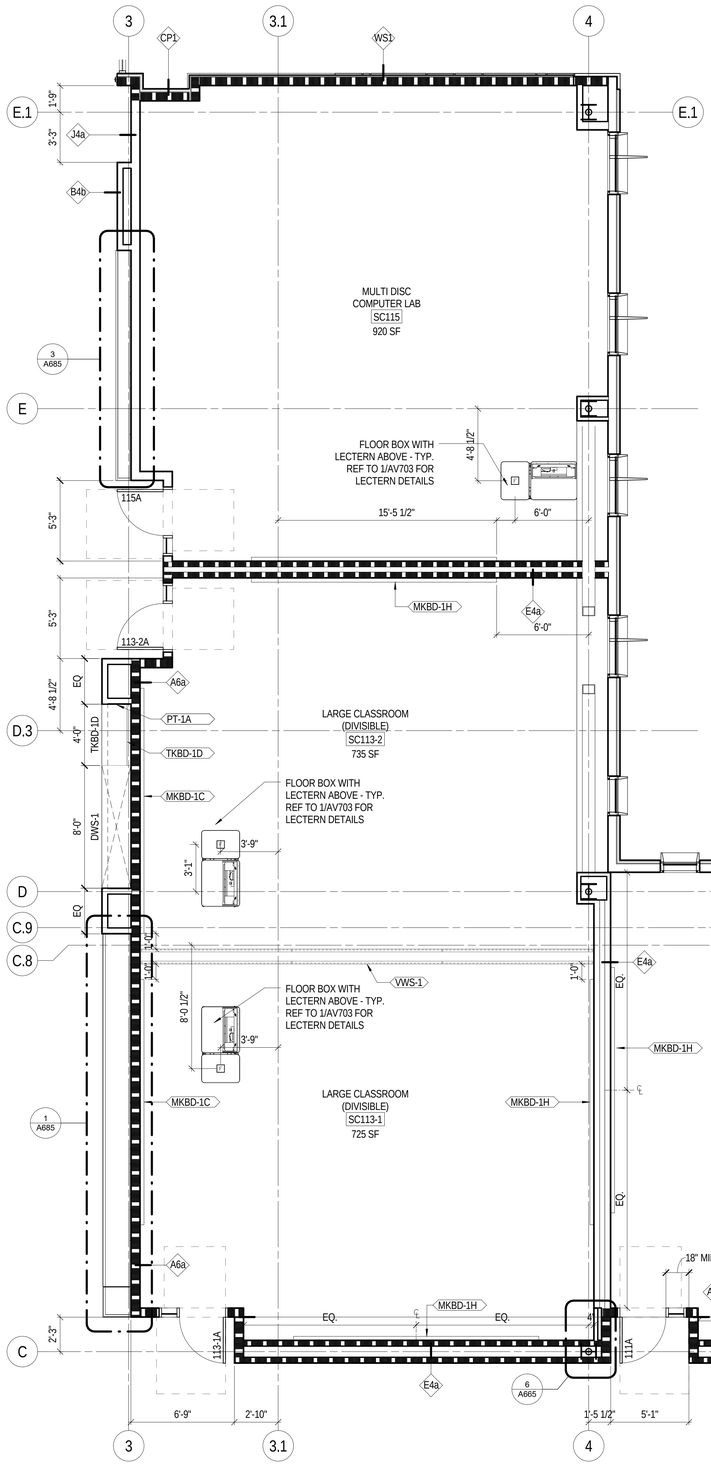
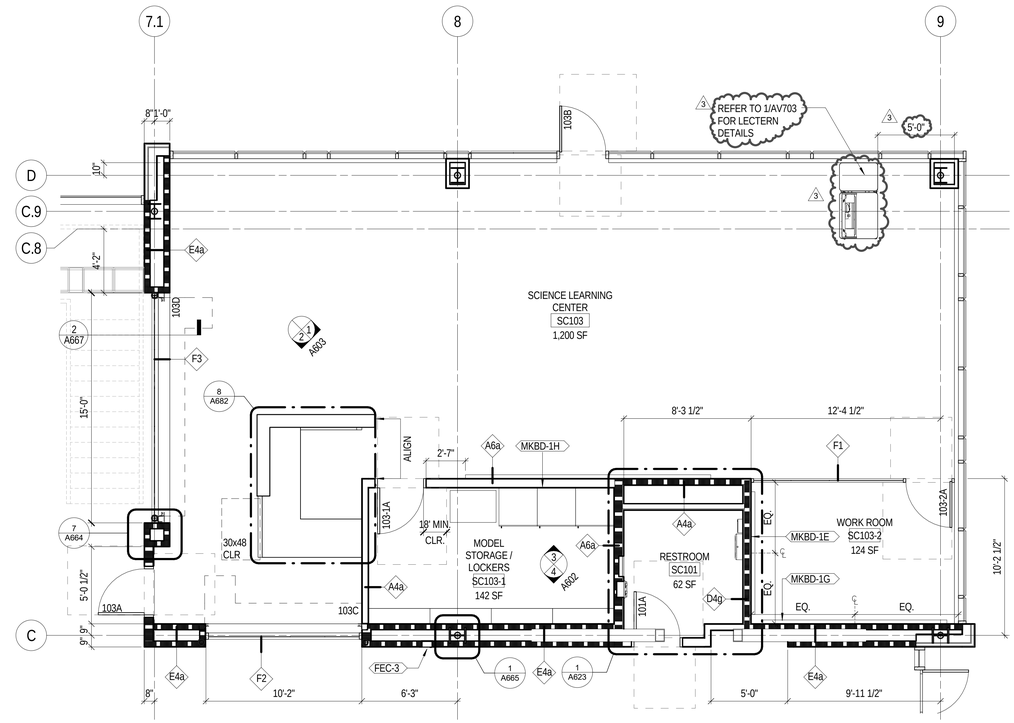


3 LARGE CLASSROOM & COMPUTER LAB - ENLARGED FLOOR PLAN
1/4" = 1'-0"



1 SCIENCE LEARNING CENTER - ENLARGED FLOOR PLAN
1/4" = 1'-0"

1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL &
PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE

RANCHO SANTIAGO
COMMUNITY COLLEGE
DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA
COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

JAMES G. MATSON
No. C13036
REGISTERED
SEPTEMBER 30, 2018
RENEWAL DATE
ARCHITECT
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR ENLARGED PLANS

DATE: JULY 06, 2017

A624

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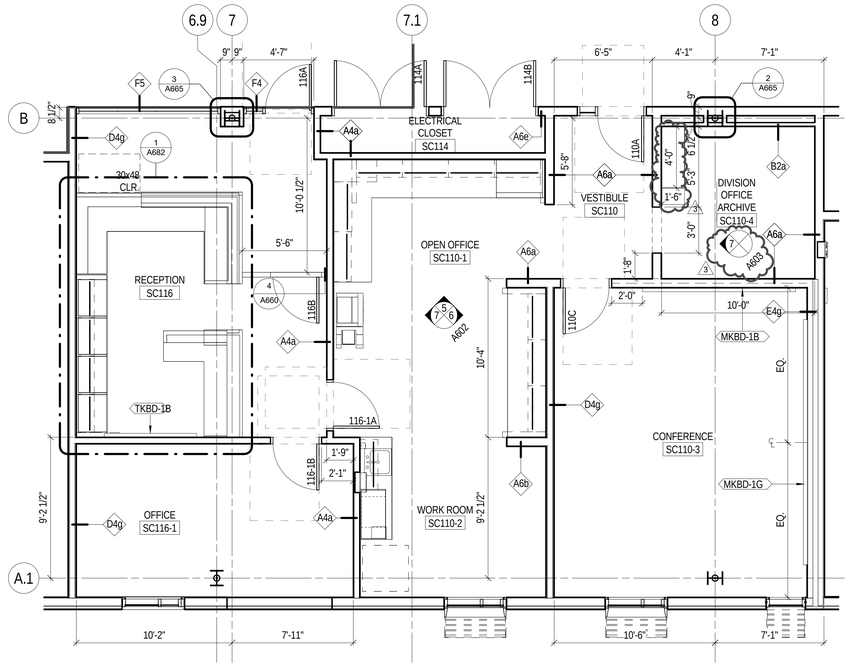
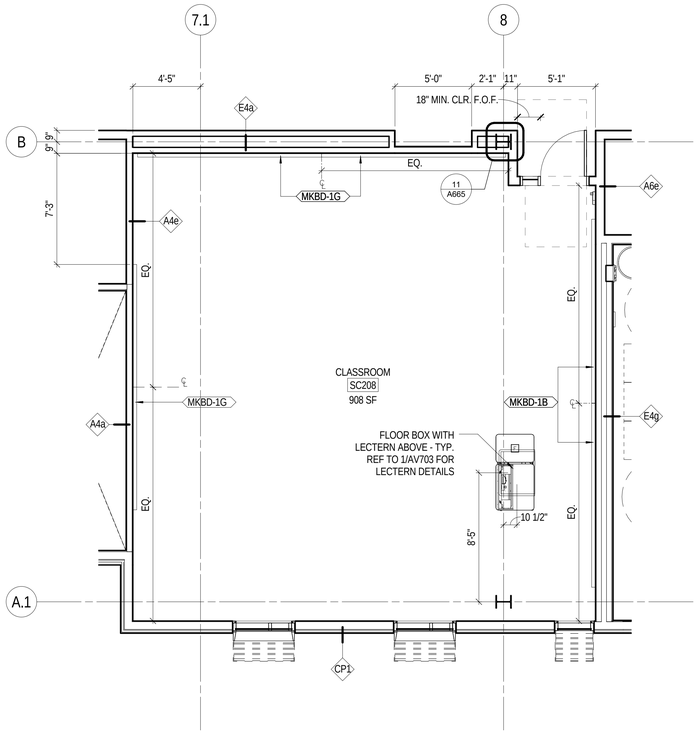
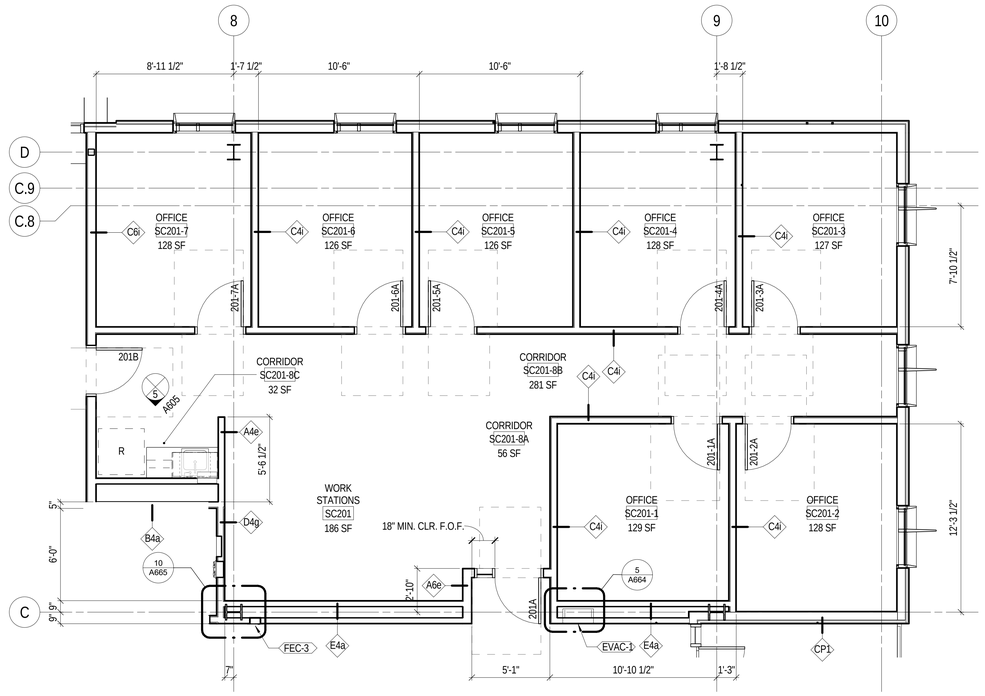


2 DIVISION OFFICE - ENLARGED FLOOR PLAN
1/4" = 1'-0"



1 TYP. CLASSROOM - ENLARGED FLOOR PLAN
1/4" = 1'-0"



3 FACULTY OFFICES - ENLARGED FLOOR PLAN
1/4" = 1'-0"

hga.
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
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DISTRICT

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SANTA ANA, CA 92706

SANTA ANA
COLLEGE

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JAMES G. MATSON
LICENSED ARCHITECT
No. C13036
SEPTEMBER 30, 2018
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR ENLARGED PLANS

DATE: JULY 06, 2017

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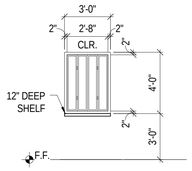
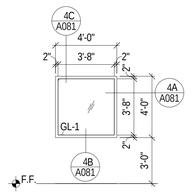


11 F11 - CENTRAL PREP & STORAGE SC322
1/4" = 1'-0"



10 F10 - INSTRUMENT RM SC320-1
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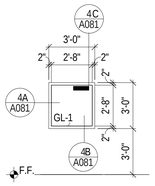
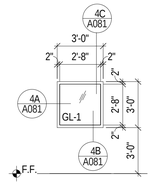
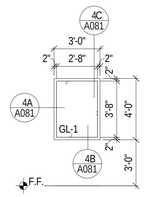


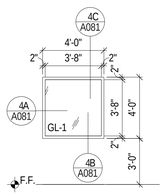
9 F9 - CHEMISTRY PREP & STORAGE SC313
1/4" = 1'-0"



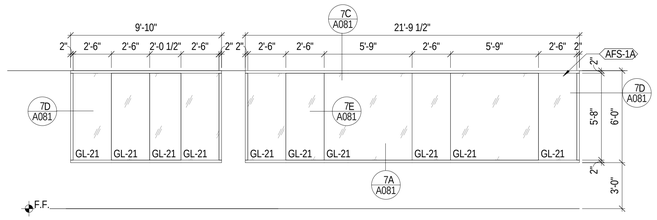
8 F8 - CHEMISTRY PREP & STORAGE SC313
1/4" = 1'-0"



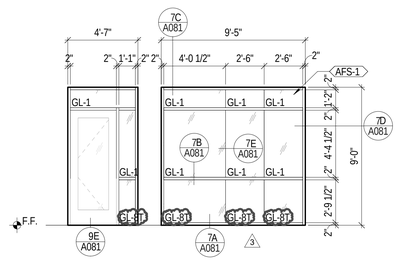
7 F7 - CHEMISTRY PREP & STORAGE SC310
1/4" = 1'-0"



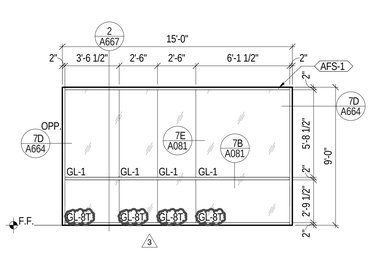
6 F6 - CADAVER RM SC217-1
1/4" = 1'-0"



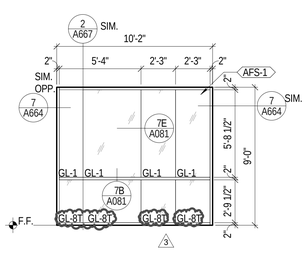
5 F6 - ENGINEERING LAB SC134
1/4" = 1'-0"



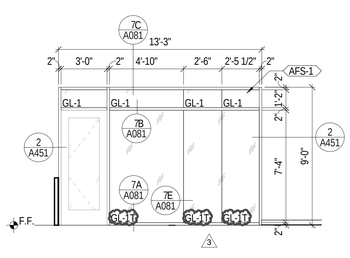
4 F5 - RECEPTION SC116
1/4" = 1'-0"



3 F3 - SCIENCE LEARNING CENTER SC103
1/4" = 1'-0"



2 F2 - SCIENCE LEARNING CENTER SC103
1/4" = 1'-0"



1 F1 - SCIENCE LEARNING CENTER SC103
1/4" = 1'-0"

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Telephone 310.557.7600

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LICENSED ARCHITECT
JAMES G. MATSON
No. C13036
SEPTEMBER 30, 2019
RENEWAL DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR GLAZING ELEVATIONS

DATE: JULY 06, 2017

A630

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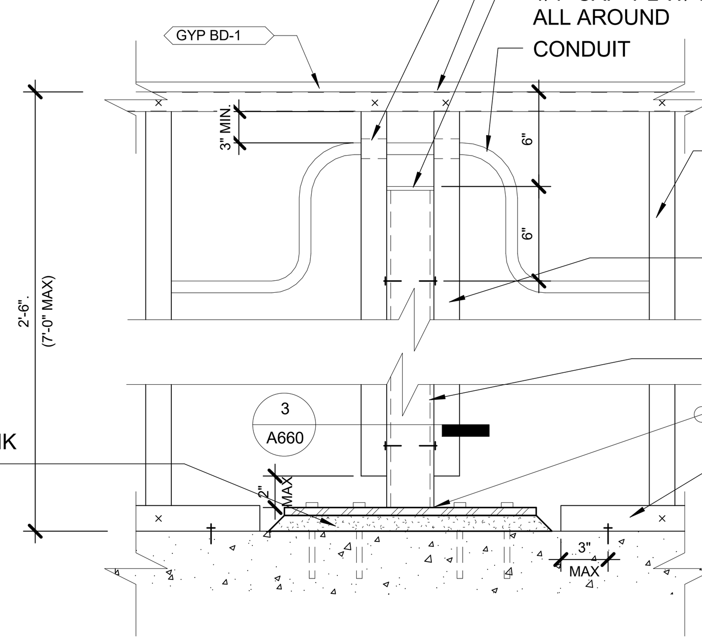
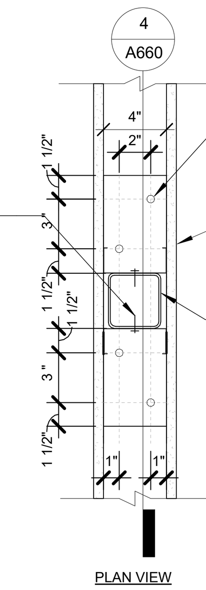


4 FRAMING ELEVATION @ PARTIAL HEIGHT STUD WALL
1 1/2" = 1'-0"



NOTE:
1. CONTINUOUS 18 GAUGE TOP TRACK
2. PROVIDE 6" BETWEEN TOP OF HSS POST & TOP TRACK, TYP

PLAN VIEW

3 PARTIAL HEIGHT INTERIOR STUD WALL
1 1/2" = 1'-0"

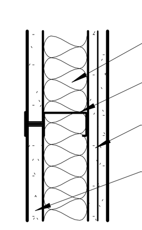
FIXTURE	TYPE	GRAPHIC	DIMENSION				
			GYPSUM BOARD AND METAL STUDS			MASONRY	
			MIN. OVERALL DIM	MIN. CLEAR SPACE	MIN. STUD SIZE	MIN. CLEAR DIM	MIN. UNIT SIZE
WATER CLOSET	WALL MOUNTED SINGLE (BACK OUTLET)		1'-10"	1'-1 1/2"	3 5/8"	1'-1"	4"
	WALL MOUNTED BACK TO BACK		2'-0"	1'-3 1/2"	3 5/8"	1'-3"	4"
	FLOOR MOUNTED SINGLE (BOTTOM OUTLET)		7 1/4"	6"	6"	6"	4"
	FLOOR MOUNTED BACK TO BACK (BOTTOM OUTLET)		7 1/4"	6"	6"	6"	4"
	FLOOR MOUNTED SINGLE (BACK OUTLET)		1'-10"	1'-1 1/2"	3 5/8"	1'-1"	4"
	FLOOR MOUNTED BACK TO BACK (BACK OUTLET)		2'-0"	1'-3 1/2"	3 5/8"	1'-3"	4"
URINAL	WALL MOUNTED SINGLE		7 1/4"	6"	6"	6"	4"
	WALL MOUNTED BACK TO WC		1'-10"	1'-1 1/2"	3 5/8"	1'-1"	4"
LAVATORY	WALL MOUNTED SINGLE		7 1/4"	6"	6"	6"	4"
	WALL MOUNTED BACK TO BACK		7 1/4"	6"	6"	6"	4"
EWC	WALL MOUNTED DUAL HEIGHT EXPOSED CHILLER		7 1/4"	6"	6"	6"	4"
	WALL MOUNTED DUAL HEIGHT RECESSED CHILLER		1'-10"	1'-1 1/2"	3 5/8"	1'-1"	4"
FLUSHING RIM SINK	WALL MOUNTED SINGLE		1'-10"	1'-1 1/2"	3 5/8"	1'-1"	4"
SLOP SINK	FLOOR MOUNTED SINGLE		7 1/4"	6"	6"	6"	4"
SHOWER	WALL MOUNTED SINGLE		4 7/8"	3 5/8"	3 5/8"	4"	4"
	WALL MOUNTED BACK TO BACK		7 1/4"	6"	6"	6"	4"

5 PLUMBING CHASE SCHEDULE
1'-0" = 1'-0"

K SERIES

NONCOMBUSTIBLE

AVAILABLE FIRE RESISTANCE: 2 HOUR
UL U417



PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
K2	2 1/2"	3 3/4"					
K4	4"	5 1/4"					
K6	6"	7 1/4"					

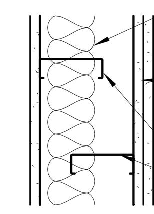
NOTES:
1. AT ALL HEADERS AND FOOTER CONDITIONS, APPLY A CONTINUOUS 3/8" THICK MINIMUM ROUND BEAD OF NON-HARDENING ACOUSTIC SEALANT ON METAL RUNNERS BEFORE INSTALLATION OF GYPSUM BOARD. INSTALL ACOUSTIC SEALANT ON BOTH SIDES OF THE PARTITION.
2. CROSS-LAY MULTIPLE GWB LAYERS; JOINTS IN MULTIPLE LAYER ASSEMBLY SHALL NOT BE LAID DIRECTLY OVER EACH OTHER

L INTERIOR PARTITION TYPE - L SERIES
1 1/2" = 1'-0"

J SERIES

NONCOMBUSTIBLE

AVAILABLE FIRE RESISTANCE: 1 HOUR
UL U415



MINUMUM STC: 45
GA WP 1081

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
J4	4"	7 1/4"					

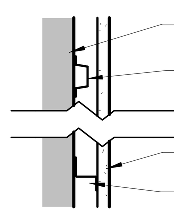
NOTES:
1.
2.
3.

J INTERIOR PARTITION TYPE - J SERIES
1 1/2" = 1'-0"

H SERIES

NONCOMBUSTIBLE

FIRE RESISTANCE: NOT AVAILABLE



MINIMUM STC:

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
H1	7/8"	1 1/2"	1	H4	2"	2 5/8"	2
H2	1"	1 5/8"	2	H5	3"	3 5/8"	2
H3	1 1/2"	2 1/8"	2				

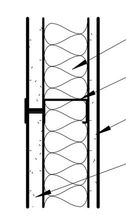
NOTES:
1. <MET FURG-1> (HAT CHANNELS)
2. <MET FURG-2> (Z-FURRING)

H INTERIOR PARTITION TYPE- H SERIES
1 1/2" = 1'-0"

G SERIES

NONCOMBUSTIBLE

FIRE RESISTANCE: 1 HOUR
UL U469



MINIMUM STC: 35
GA WP 7008

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
G2	2 1/2"	3 1/8"					
G4	4"	4 5/8"					
G6	6"	6 5/8"					

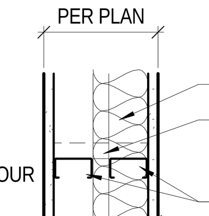
NOTES:
1.
2.
3.

G INTERIOR PARTITION TYPE- G SERIES
1 1/2" = 1'-0"

E SERIES

NONCOMBUSTIBLE

FIRE RESISTANCE: 1 HOUR
UL U420



MINIMUM STC: 50
GA WP5015

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
E1	1 5/8"	-		E4	4"		1
E2	2 1/2"	-		E6	6"		1
E3	3 5/8"	-					

NOTES:
1. AT ALL RESTROOMS PROVIDE GYP BD-2
2.

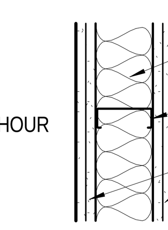
NOTES TO DETAILER
1. 3 1/2" INSULATION IS THE MAXIMUM ALLOWED TO MAINTAIN THE FIRE RESISTANCE RATING.
2. THIS PARTITION TYPE IS AVAILABLE IN A 2 HOUR RATED ASSEMBLY AS WELL, REFER TO UL DESIGN U420 FOR MORE INFORMATION.

E INTERIOR PARTITION TYPE- E SERIES
1 1/2" = 1'-0"

D SERIES

NON COMBUSTIBLE

FIRE RESISTANCE: 2 HOUR
UL U420



MINIMUM STC: 55
GA WP1548

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
D1	1 5/8"	4 1/8"	1	D4	4"	6 1/2"	
D2	2 1/2"	5"	2	D6	6"	8 1/2"	
D3	3 5/8"	6 1/8"					

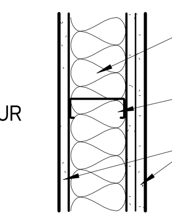
NOTES:
1.
2.
3.

D INTERIOR PARTITION TYPE- D SERIES
1 1/2" = 1'-0"

C SERIES

NONCOMBUSTIBLE

FIRE RESISTANCE: 1 HOUR
UL U448



MINIMUM STC: 50
GA 1021

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
C2	2 1/2"	4 3/8"		C6	6"	7 7/8"	
C3	3 5/8"	5 1/2"					
C4	4"	5 7/8"					

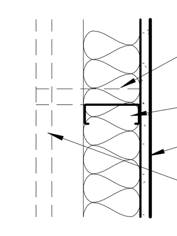
NOTES:
1.
2.
3.

C INTERIOR PARTITION TYPE- C SERIES
1 1/2" = 1'-0"

B SERIES

NONCOMBUSTIBLE

FIRE RESISTANCE: NOT AVAILABLE



MINIMUM STC:

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
B1	1 5/8"	2 1/4"	1	B4	4"	4 5/8"	2, 3
B2	2 1/2"	3 1/8"	1	B6	6"	6 5/8"	2, 3
B3	3 5/8"	4 1/4"	2				

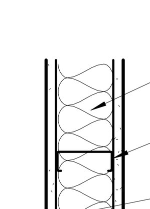
NOTES:
1. PROVIDE BRACES TO BACK-UP AT 4'-0" ON CENTER MAXIMUM VERTICALLY
2. PROVIDE BRACES TO BACK-UP AT VERTICAL MIDPOINT OF STUD WHERE UNBRACED HEIGHT EXCEEDS 12'-0"
3. AT ALL RESTROOMS PROVIDE GYP.BD-2

B INTERIOR PARTITION TYPE- B SERIES
1 1/2" = 1'-0"

A SERIES

NONCOMBUSTIBLE

FIRE RESISTANCE: 1 HOUR
UL U415



MINIMUM STC: 45
GA WP1081

PLAN VIEW

PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES	PTN TYPE	STUD WIDTH	PTN WIDTH	NOTES
A2	2 1/2"	3 3/4"		A6	6"	7 1/4"	1
A3	3 5/8"	4 7/8"		A8	8"	9 1/4"	
A4	4"	5 1/4"	1				

NOTES:
1. AT ALL RESTROOMS PROVIDE GYP BD-2
2.
3.

A INTERIOR PARTITION TYPE- A SERIES
1 1/2" = 1'-0"

GENERAL NOTES - INTERIOR PARTIONS

A. MINIMUM STC RATINGS INDICATED ARE BASED ON PARTITION TYPE WITH "a" MODIFIER ONLY
B. FILL EACH JOINT AND PENETRATION IN EACH PARTITION WITH INSULATION TO ACHIEVE ACOUSTIC RATING (STC). AND SEAL.
C. TYPICAL FLOOR PLAN DIMENSIONS FOR PARTITIONS ARE TO FINISH FACE OF GYPSUM BOARD OR MASONRY UNLESS NOTED OTHERWISE. MAINTAIN DIMENSION BETWEEN FACE OF FINISHES.
D. "CLEAR" OR "HOLD" DIMENSION DENOTES MINIMUM CLEARANCE REQUIRED BETWEEN PARTITION FINISHES.
E. TYPICAL GYPSUM BOARD PARTITION WIDTH IS BASED ON 5/8" GYPSUM BOARD UNLESS NOTED OTHERWISE.
F. REFER TO SHEET A662 FOR PARTITION DETAILS.
G. PARTITION TYPES SHOW GENERAL REQUIREMENTS FOR PARTITIONS. REFER TO SPECIFICATIONS, PRODUCT TECHNICAL DATA AND REQUIREMENTS OF APPLICABLE TESTING AGENCIES FOR SPECIFICS OF PARTITION CONSTRUCTION REQUIREMENTS.
H. PARTITION REQUIREMENTS SHOWN ARE MINIMUM STANDARDS. WHERE ACTUAL CONDITIONS CAUSE PARTITION(S) TO EXCEED LIMITS [PER MANUFACTURER'S RECOMMENDATIONS], REINFORCE PARTITION(S) AS REQUIRED.
I. PROVIDE FIRESTOPPING AT PENETRATIONS AND CONNECTIONS TO ADJACENT ASSEMBLIES IN FIRE-RATED PARTITIONS COMPLIANT WITH APPLICABLE TESTING AGENCY REQUIREMENTS.
J. REFER TO STRUCTURAL DRAWINGS FOR EXTENT AND DESCRIPTION OF INTERIOR STRUCTURAL WALLS NOT IDENTIFIED BY PARTITION TYPES AND/OR INDICATED AS: <STR>
K. PROVIDE BLOCKING OR BACKER MATERIAL FOR ATTACHMENT AND MOUNTING OF WALL HUNG ITEMS OR EQUIPMENT SHOWN ON 1G/S0.50. PROVIDE FIRE RETARDANT TREATED BLOCKING WHERE SPECIFIED OR REQUIRED BY CODE.
L. FIRE AND/OR ACOUSTIC TEST REFERENCES CALLED OUT MAY VARY DEPENDING ON THE MANUFACTURER OF COMPONENTS ACTUALLY USED.
M. PROVIDE WATER RESISTANT GYPSUM BOARD (GYP BD-2) AT AREAS REQUIRED BY CODE AND WHERE FINISH WILL BE CERAMIC TILE UNLESS NOTED OTHERWISE.
3 N. NOT USED
O. NOT USED
P. ENSURE FINISH SURFACES ARE FLUSH AND SEAMLESS WHERE PARTITIONS AND/OR FURRING ARE COPLANAR.

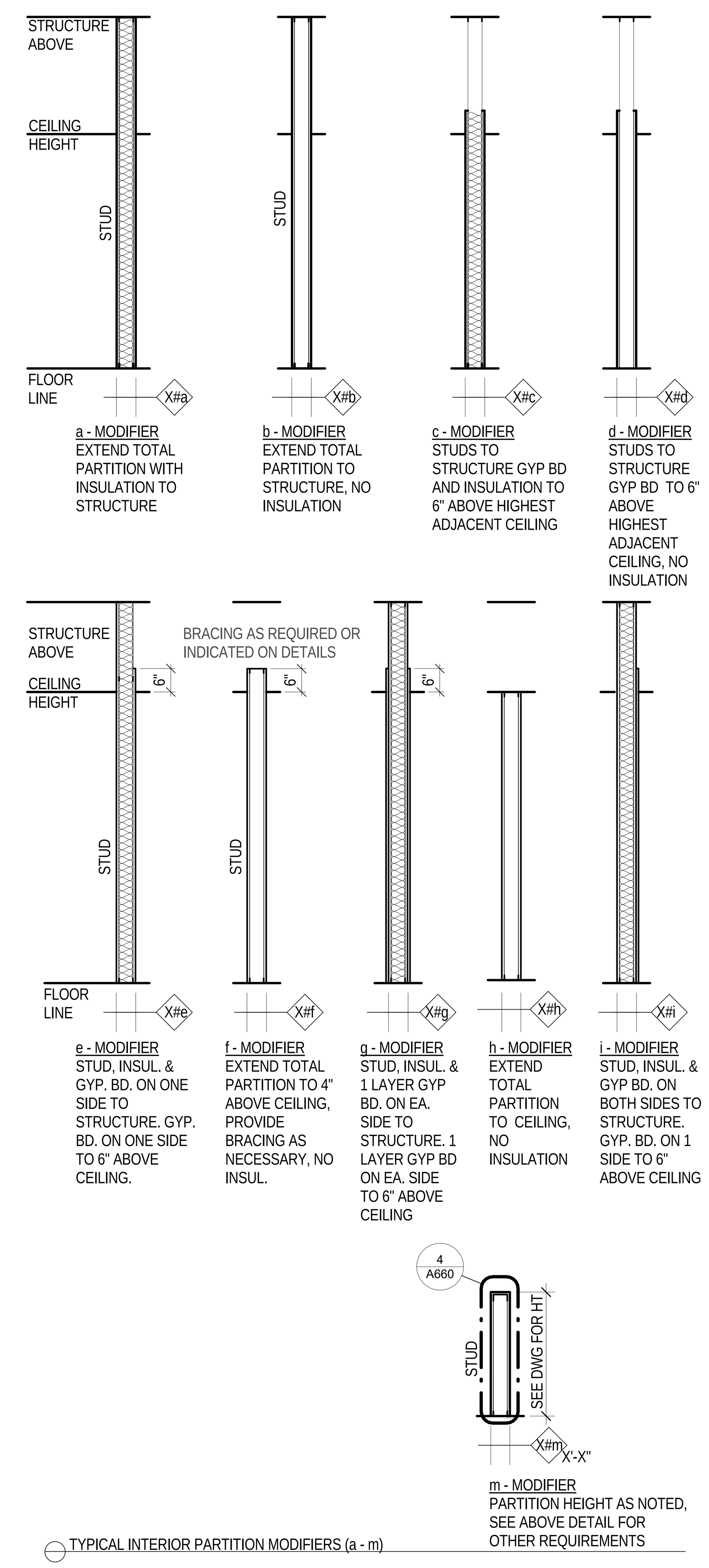
1. SERIES
THIS CHARACTER DENOTES THE ASSEMBLY SERIES TO WHICH THE WALL BELONGS.

2. METAL STUD/MASONRY UNIT SIZE DESIGNATOR
THIS CHARACTER DENOTES THE STUD OR FURRING WIDTH. FOR MASONRY, THIS CHARACTER INDICATES NOMINAL UNIT WIDTH.

3. MODIFIER
THIS CHARACTER DENOTES MODIFICATION(S) TO THE SERIES ASSEMBLY.

PARTITION NAMING LEGEND
A3d
1. SERIES
2. STUD/MASONRY SIZE DESIGNATOR
3. MODIFIER

2 PARTITION NAMING LEGEND
1 1/2" = 1'-0"



1 INTERIOR PARTITION MODIFER KEY
1/2" = 1'-0"

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1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

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818-377-8220

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COSTA MESA, CA 92626
949-852-9995

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KPFF CONSULTING ENGINEERS
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213-418-0201

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IRVINE, CA 92614
949-756-0150

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RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

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RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2019 RENEWAL DATE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS REVIEW BY: Approver

HGA NO: 3584-001-00

INTERIOR PARTITION TYPES

DATE: JULY 06, 2017

A660

ADDENDA PACKAGE

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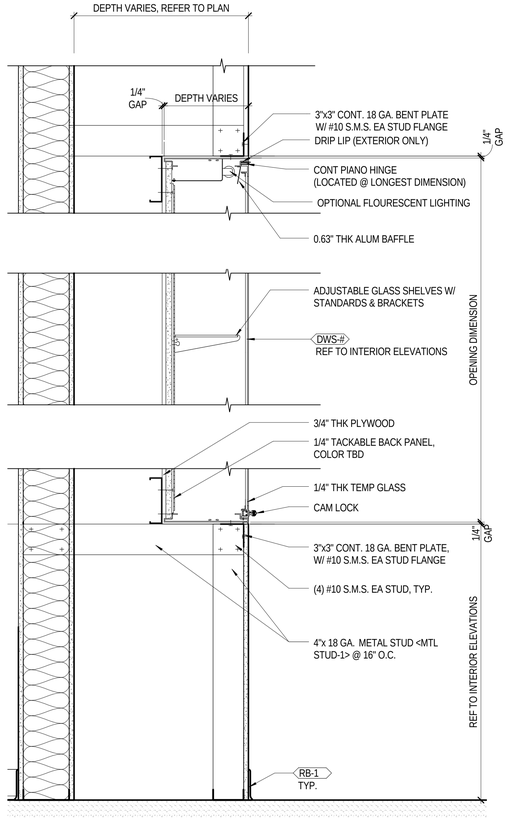
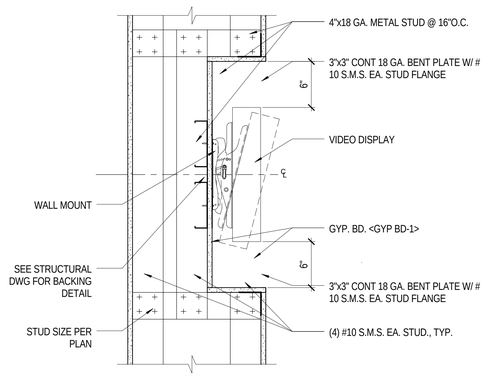
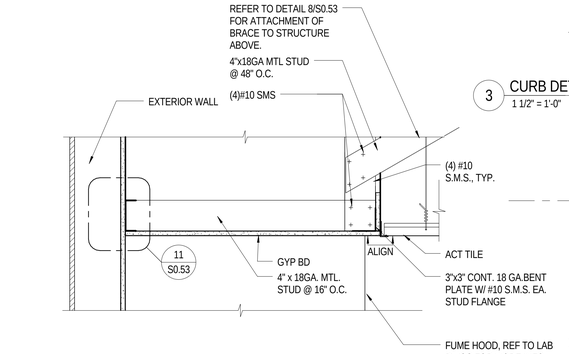


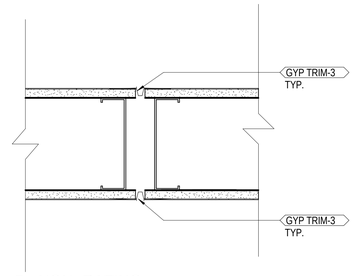
10 SECTION DETAIL AT VIDEO DISPLAY
1 1/2" = 1'-0"



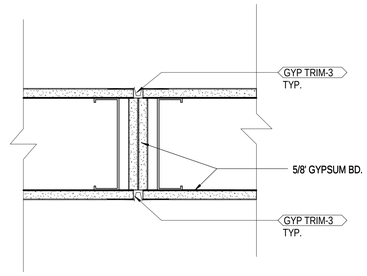
7 SOFFIT DETAIL AT FUME HOOD AND BULKHEAD
1 1/2" = 1'-0"



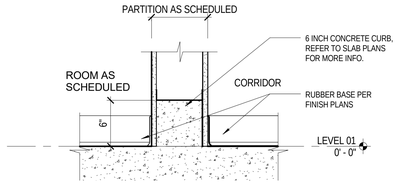
11 GYPSUM BOARD CONTROL JOINT DETAIL
3" = 1'-0"



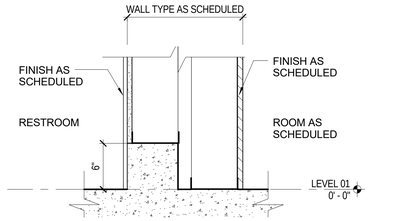
A NON- RATING



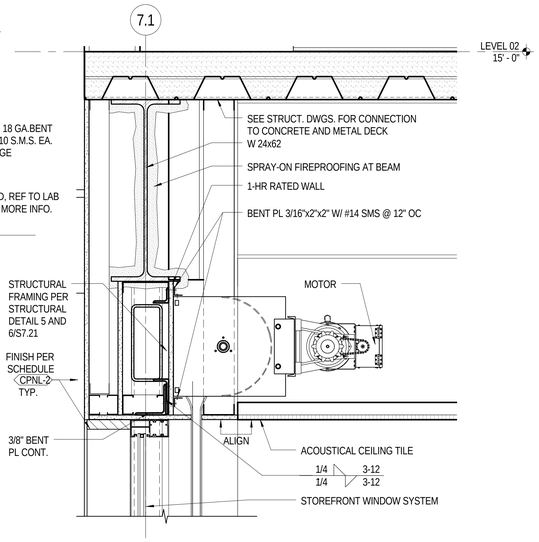
B 1-HR. FIRE RATING



4 CURB DETAIL, TYP.
1 1/2" = 1'-0"



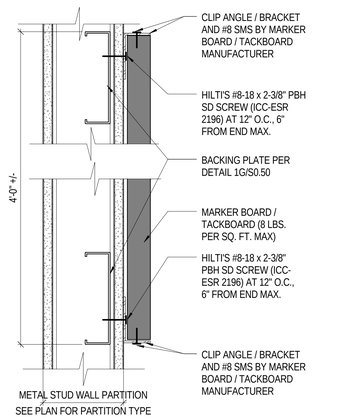
3 CURB DETAIL AT RESTROOMS
1 1/2" = 1'-0"



NOTE: REFER TO 6/A673 FOR ADDITIONAL INFORMATION ON OVERHEAD COILING DOOR

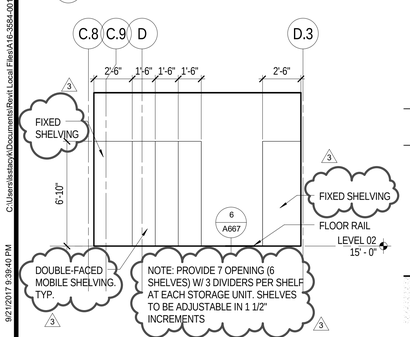
2 OVERHEAD COILING DOOR - TYPICAL
1 1/2" = 1'-0"

13 DETAIL - DISPLAY CASE
1 1/2" = 1'-0"

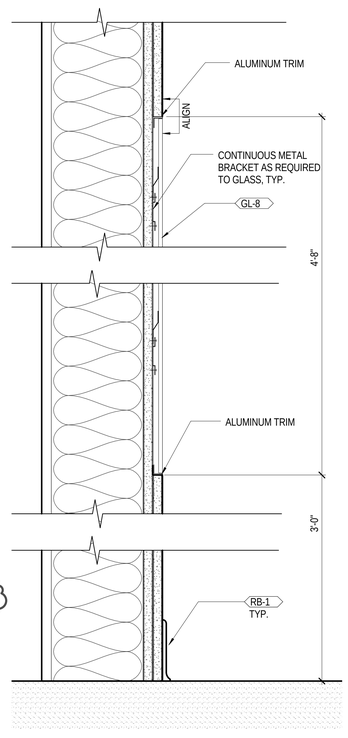


BRACKET ATTACHMENT FOR TACKBOARD/ MARKERBOARD

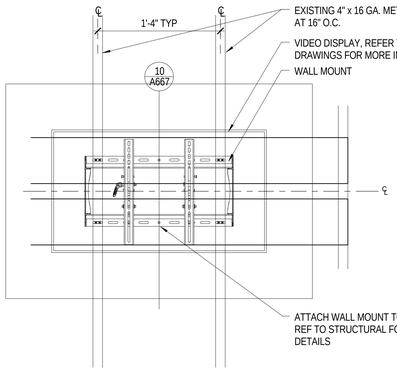
15 3" = 1'-0"



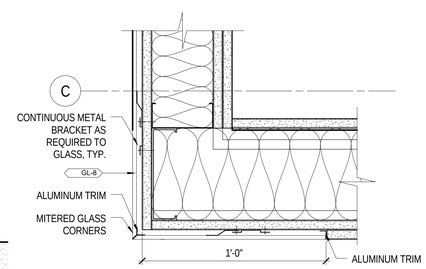
14 SECTION AT HIGH DENSITY STORAGE
1/4" = 1'-0"



12 SECTION DETAIL AT GLASS MARKERBOARD
3" = 1'-0"

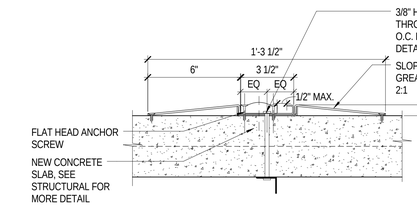


9 ELEVATION OF WALL MOUNT
1 1/2" = 1'-0"

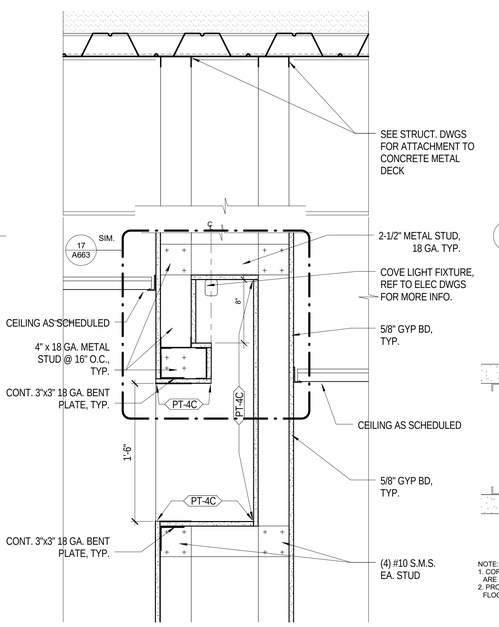


ENLARGED PLAN DETAIL AT GLASS MARKERBOARD, SECOND AND THIRD LEVEL, TYP.

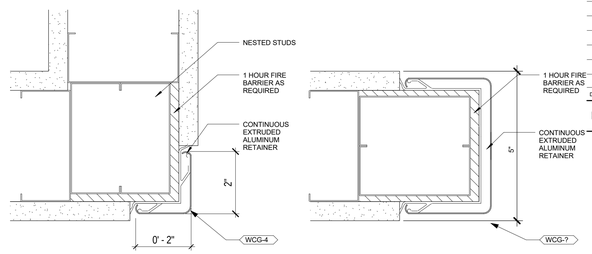
8 3" = 1'-0"



6 FLOOR RAIL DETAIL AT HIGH DENSITY STORAGE
3" = 1'-0"



5 DETAIL AT WALL ALCOVE IN CORRIDORS
1 1/2" = 1'-0"



NOTE:
1. CORNER GUARDS SHALL BE RATED AND LISTED FOR THE ASSEMBLY TO WHICH THEY ARE TO BE APPLIED
2. PROVIDE FIRE BARRIER BEHIND CORNER GUARDS AT RATED CONDITIONS. REFER TO FLOOR PLANS FOR CORNER GUARD LOCATIONS.

1 WALL CORNER GUARD - TYPICAL
6" = 1'-0"

hga.
1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

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COSTA MESA, CA 92626
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1530 W. 17TH ST.
SANTA ANA, CA 92706

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA.

LICENSED ARCHITECT JAMES G. MATSON No. C13036 SEPTEMBER 30, 2018 RENEWAL DATE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: SK | REVIEW BY: Approver

HGA NO: 3584-001-00

MISC. INTERIOR DETAILS

DATE: JULY 06, 2017

A667

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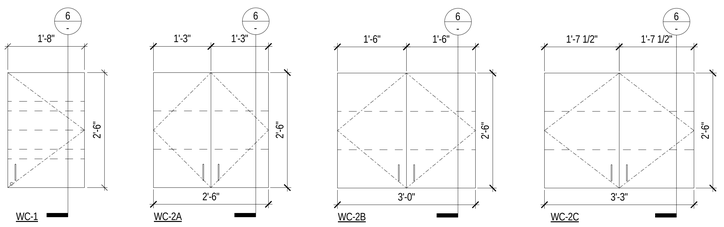
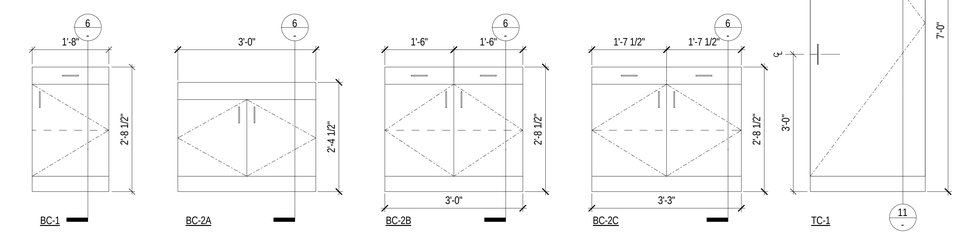
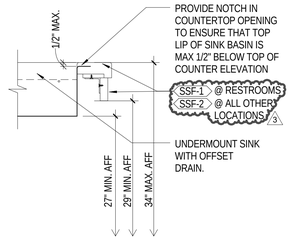


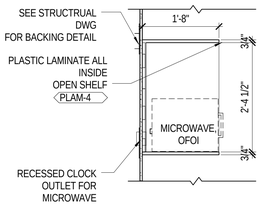
TYPICAL WALL CABINET TYPE



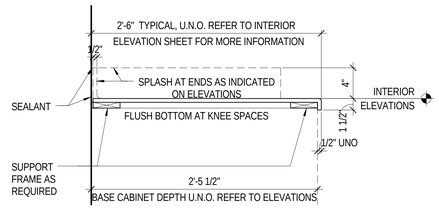
TYPICAL BASE DRAWER TYPES



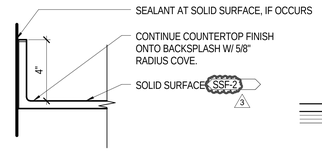
14 SINK NOTCH INTO COUNTERTOP DETAIL
1 1/2" = 1'-0"



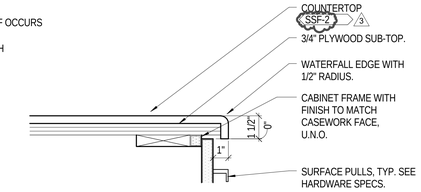
13 WALL CABINET W/ MICROWAVE
3/4" = 1'-0"



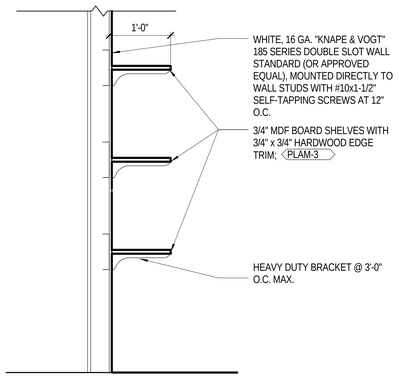
10 TYPICAL COUNTERTOP INFORMATION
1 1/2" = 1'-0"



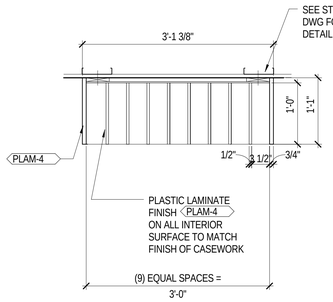
8 LOW HEIGHT BACKSPLASH (COVED)
3" = 1'-0"



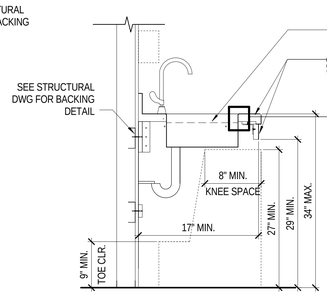
5 COUNTER EDGE - WATERFALL
3" = 1'-0"



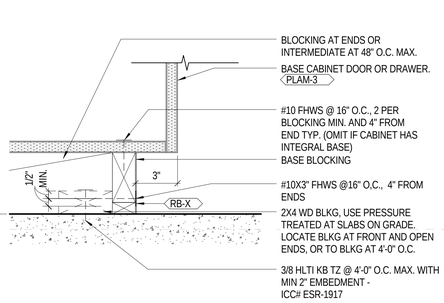
9 TYPICAL MAIL BOX SLOT
1" = 1'-0"



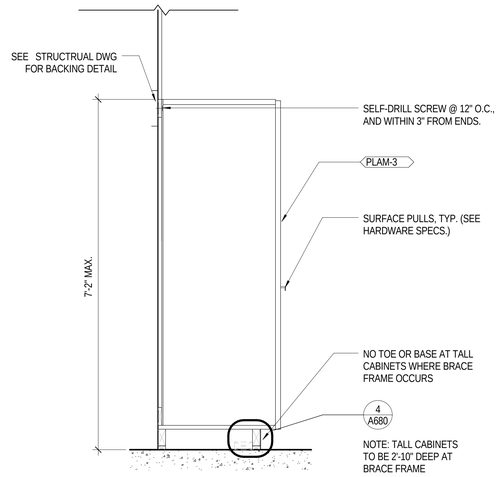
7 ACCESSIBLE SINK/LAVATORY WITH REMOVABLE APRON
1" = 1'-0"



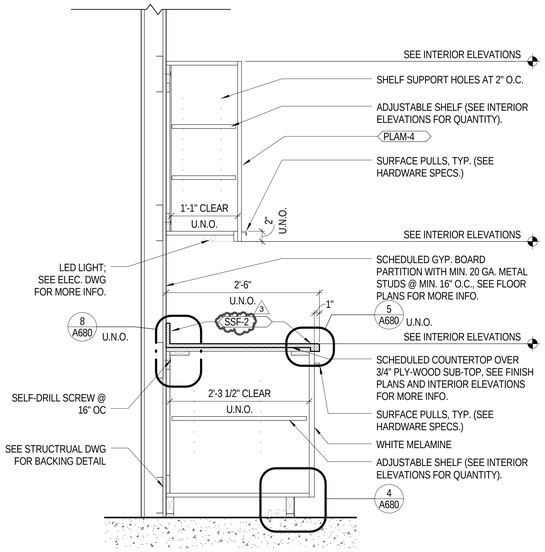
4 RECESSED TOE KICK - STANDARD (4")
3" = 1'-0"



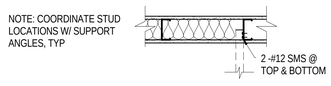
12 ADJUSTABLE HEAVY DUTY OPEN SHELVES
1" = 1'-0"



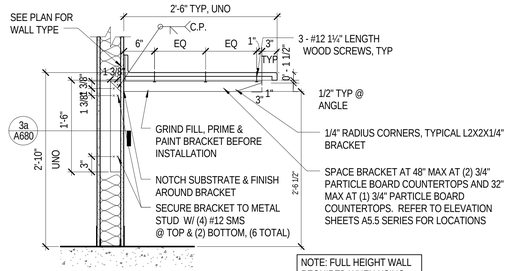
11 FLOOR CABINET TALLER THAN 3'-0"
1" = 1'-0"



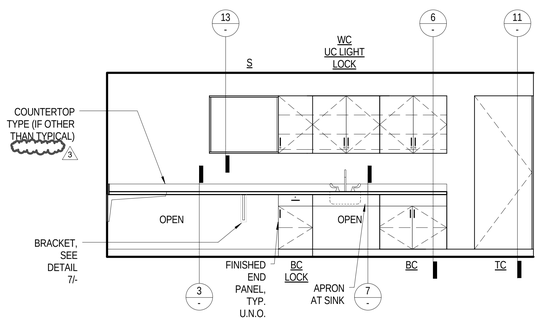
6 TYPICAL ARCHITECTURAL CASEWORK SECTION
1" = 1'-0"



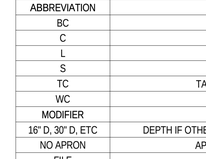
3a PLAN SECTION @ COUNTERTOP BRACKET
1" = 1'-0"



3 COUNTERTOP BRACKET
1" = 1'-0"



2 CASEWORK TAG AND MODIFIERS
1/2" = 1'-0"



1 TYPICAL ARCHITECTURAL CASEWORK ELEVATIONS.
3/8" = 1'-0"

GENERAL NOTES - ARCHITECTURAL CASEWORK

NOTATION REFERING TO "CASEWORK" SHALL REFER TO BOTH ARCHITECTURAL CASEWORK AND MILLWORK, UNLESS NOTED OTHERWISE.

A. NOT ALL COMPONENTS AND/OR TYPES NECESSARILY USED.

B. ALL CASEWORK COUNTERTOPS SHALL BE SSF-2, U.O.N.; ALL BASE CASEWORK AND TALL STORAGE CABINET SHALL BE PLAM-3, U.N.O.; ALL WALL CASEWORK SHALL BE PLAM-4, U.O.N.

C. TALL CABINET STORAGE TO BE 2'-0" DEEP, U.O.N.

D. WALL CABINETS TO BE 1'-1" DEEP CLEAR INSIDE, U.O.N.

E. BASE CABINETS TO BE 2'-0" DEEP, U.O.N.

F. SET TOPS OF ALL WALL CABINET CASEWORK AT 7'-6" ABOVE THE FLOOR, UNLESS OTHERWISE SHOWN OR NOTED .

G. CABINET FACE TYPES SHALL BE FLUSH OVERLAY, U.O.N.

H. ALL BASE CABINETS AND TALL STORAGE CABNETS SHALL HAVE PLAM-3, FINISH PANELS AT ENDS; ALL WALL CABINETS SHALL HAVE PLAM-4, FINISH PANELS AT ENDS.

I. CABINET BASE AT FLOOR TO HAVE FINISH AS INDICATED FOR ROOM OR AS DETAILED. REFER TO ROOM FINISH SCHEDULE.

J. REFER TO ELEVATIONS FOR QUANTITY OF ADJUSTABLE SHELVING AND CONFIGURATION. SHELF MATERIAL SHALL MATCH CABINET MATERIAL, U.O.N.

K. ALL SHELVING STANDARDS TO HAVE A MAXIMUM DISTANCE OF 2'-0" AND BE LOCATED 6" FROM THE END OF THE SHELVES.

L. ALL CASEWORK TO BE ANCHORED TO BACKING PLATES. REFER TO DETAIL 7/A622 FOR ANCHORAGE/BACKING DETAILS.

M. WALL CABINETS WITH VALANCE FOR UNDER CABINET LIGHTS SHALL NOT HAVE AN INTERMEDIATE SUPPORT AT MULTIPLE ARRANGEMENTS OF CABINETS.

N. METAL BRACKETS, WHERE REQUIRED TO SUPPORT COUNTERTOPS, SHALL BE NOT LESS THAN 2'-8" OR GREATER THAN 4'-0" OC MAXIMUM AND 6" OC MAXIMUM FROM OPEN END. ATTACH TO STUD OR BACKER AS INDICATED IN DETAIL 7/-. USE METAL BRACKET TYPE A, U.O.N.

O. PROVIDE PAINTED 1x4 MINIMUM HARDWOOD CLEAT BETWEEN BRACKET AND WALL WHERE COUNTER TOPS TERMINATE AT WALL WITHOUT BASE CABINET. BRACKET FINISH TO MATCH WALL COLOR, U.O.N.

P. TYPICAL CABINETRY PROFILES SHOWN TO CONVEY CRITICAL DIMENSIONS. REFER TO ELEVATIONS FOR SPECIFIC CONFIGURATIONS. REFER TO SPECIFICATIONS FOR JOINERY AND QUALITY REQUIREMENTS.

Q. COUNTERTOPS SHALL BE SSF-2, U.O.N. REFER TO MATERIAL IDENTIFICATION LIST FOR MORE INFORMATION.

R. MINIMIZE OPEN JOINTS IN COUNTERTOPS. SEAL ANY OPEN JOINTS WITH FOOD AND DRUG ADMINISTRATION APPROVED SILICONE.

S. COUNTER TOPS TO HAVE A 1/2" RADIUS AT ALL EXPOSED OUTSIDE CORNERS, U.O.N.

T. GROMMETS: PROVIDE A GROMMET AT EACH LOCATION WHERE POWER OR SIGNAL DEVICES OCCUR BELOW A COUNTERTOP, U.O.N.

U. CLOSURE SCRIBES AT CONDITIONS WHERE CASEWORK MEETS ADJACENT WALL TO BE 1-1/2" WIDE, U.N.O.

V. INSDIE FACE OF CASEWORK WITH DOORS AND INSIDE FACE OF DOORS TO BE WHITE MELAMINE.

W. CABINET ANCHORAGE

VERTICAL LOAD REQUIREMENT: TABLE 1607A.1 CBC (PART 2, VOLUME 2, TITLE 24, CCR)
LATERAL LOAD REQUIREMENT: ASCE 7-05 CHAPTER 13, TABLE 13.5-1

PROVIDE BRACING AND ANCHORAGE DETAILS FOR WALL HUNG CABINETS AND FLOOR SUPPORTED STORAGE RACKS, CABINETS, AND BOOK STACKS OVER FIVE FEET IN HEIGHT. DESIGN SUPPORTING PARTITIONS AND WALLS TO RESIST FORCES APPLIED BY CABINET ANCHORAGE.

CASEWORK TAG LEGEND

ABBREVIATION	DEFINITION
BC	BASE CABINET
C	WORK COUNTER
L	LOCKER
S	SHELVES (OPEN)
TC	TALL BASE CABINET (FLOOR MOUNTED)
WC	WALL CABINET
MODIFIER	DEFINITION
16" D, 30" D, ETC	DEPTH IF OTHER THAN TYPICAL (2'-0" FOR BASE, 1'-1" FOR WALL)
NO APRON	APRON NOT REQUIRED AT OPEN SPACE
FILE	DRAWERS TO BE FILE CABINETS
LOCK	PROVIDE LOCK (SEE SPECS AND GENERAL NOTES FOR MORE INFO)
SLIDE	SLIDING DOORS (SEE DETAIL X/AXXX)
UC LIGHT	UNDERCABINET LIGHT FIXTURE (SEE SPECS AND GENERAL NOTES)

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA.

JAMES G. MATSON
LICENSED ARCHITECT
REGISTERED PROFESSIONAL ENGINEER
SEPTEMBER 30, 2019
EXPIRATION DATE
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

TYPICAL CASEWORK NOTES, DETAILS, & PROFILE

DATE: JULY 06, 2017

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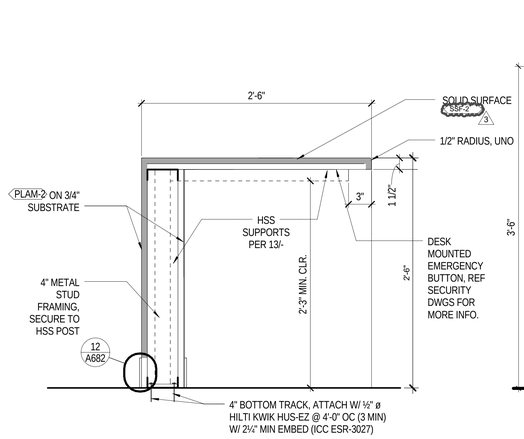
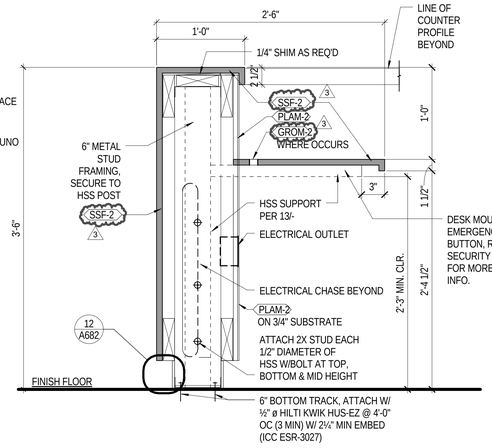


16 RECEPTION DESK COUNTER DETAIL WITH BRACKET
1 1/2" = 1'-0"



15 RECEPTION COUNTER
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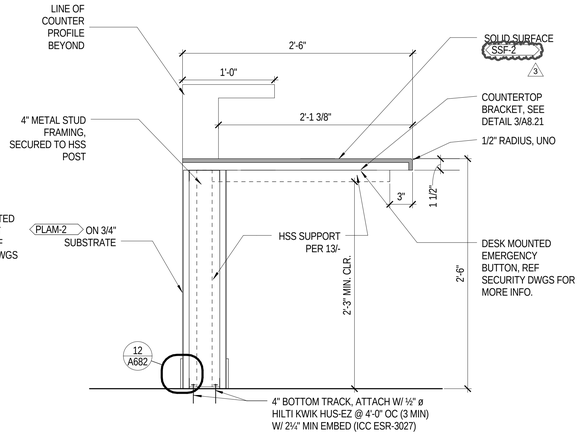

14 RECEPTION COUNTER (ACCESSIBLE)
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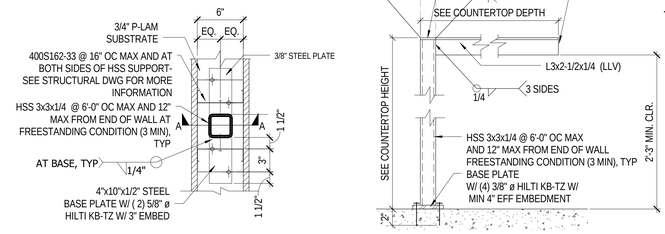


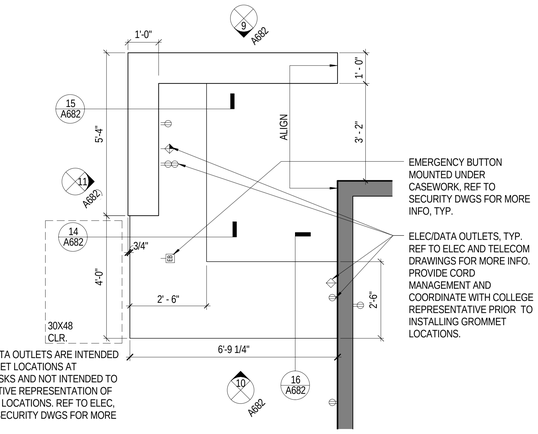
13 HSS @ RECEPTION DESK COUNTER
1 1/2" = 1'-0"

12 CASEWORK INTEGRATED TOE KICK
3" = 1'-0"

11 RECEPTION DESK SC103 - WEST ELEVATION
1/2" = 1'-0"

10 RECEPTION DESK SC103 - SOUTH ELEVATION
1/2" = 1'-0"

9 RECEPTION DESK SC103 - NORTH ELEVATION
1/2" = 1'-0"



8 RECEPTION DESK SC103 - ENLARGED PLAN
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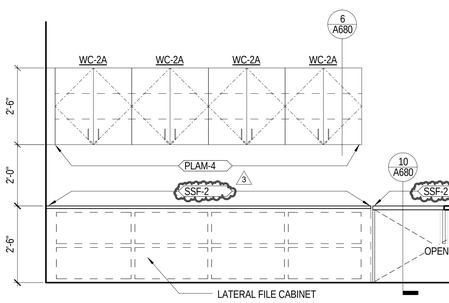
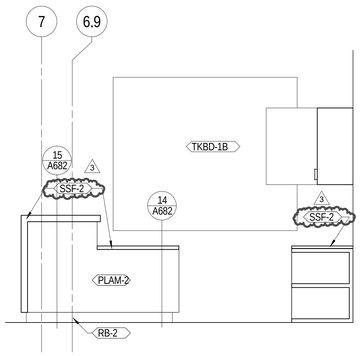
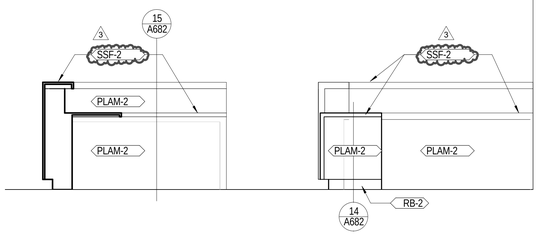


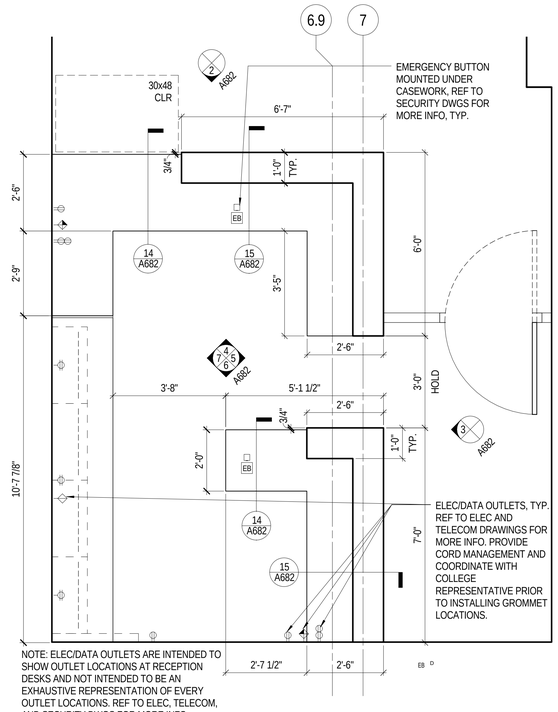
7 RECEPTION DESKS SC116 - WEST ELEVATION
1/2" = 1'-0"



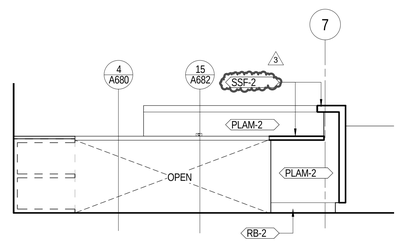
6 RECEPTION DESKS SC116 - SOUTH ELEVATION
1/2" = 1'-0"



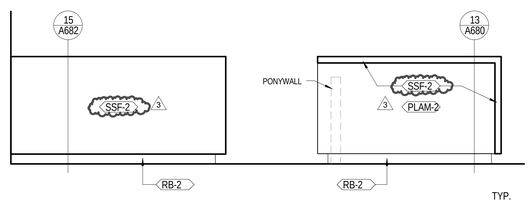
5 RECEPTION DESKS SC116 - EAST ELEVATION
1/2" = 1'-0"



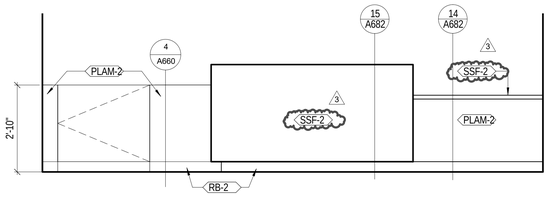
1 RECEPTION DESKS SC116 - ENLARGED PLAN
1/2" = 1'-0"



4 FIRST FLOOR - RECEPTION SC116 - NORTH ELEVATION
1/2" = 1'-0"



3 RECEPTION DESKS SC116- WEST ELEVATION
1/2" = 1'-0"



2 RECEPTION DESKS SC116 - NORTH ELEVATION
1/2" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON No. C13036 STATE OF CALIFORNIA
SEPTEMBER 30, 2019 RENEWAL DATE

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	9/1/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

CASEWORK AND RECEPTION DESKS DETAILS

DATE: JULY 06, 2017

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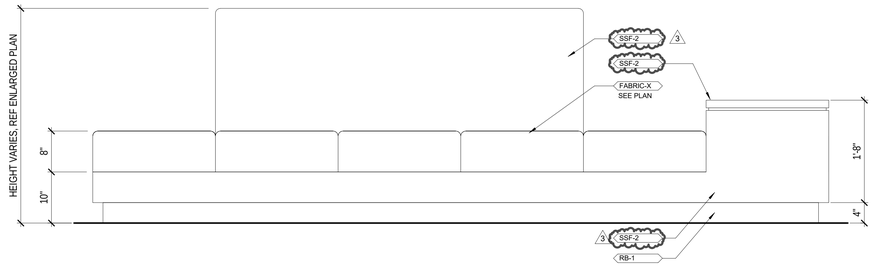
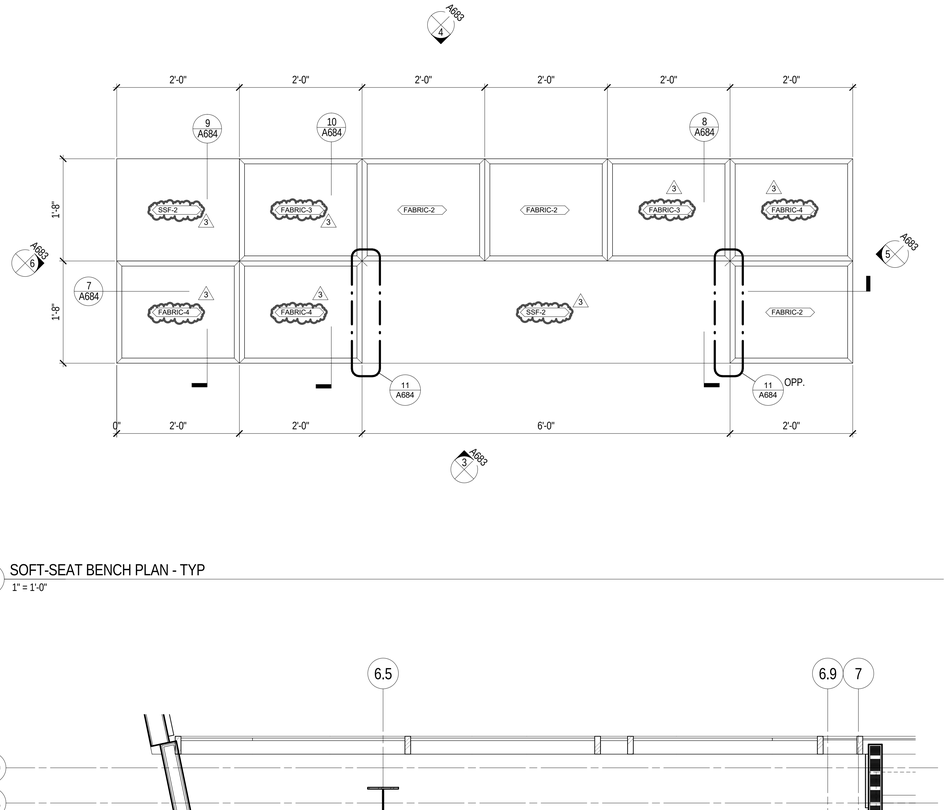


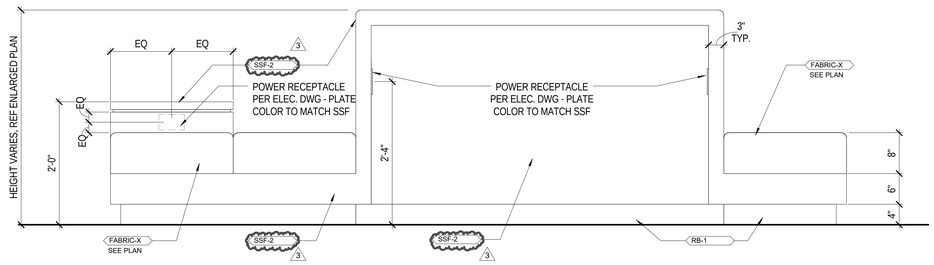
4 SOFT-SEAT BENCH ELEVATION 1 - TYP.
1" = 1'-0"



2 SOFT-SEAT BENCH PLAN - TYP
1" = 1'-0"

6 SOFT-SEAT BENCH ELEVATION 3 - TYP
1" = 1'-0"

5 SOFT-SEAT BENCH ELEVATION 2 - TYP
1" = 1'-0"



3 SOFT-SEAT BENCH ELEVATION 4 - TYP
1" = 1'-0"

1 ENLARGED CORRIDOR PLAN
1/2" = 1'-0"

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JAMES G. MATSON
No. C13036
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

CASEWORK AT
CORRIDOR
SC207

DATE: JULY 06, 2017

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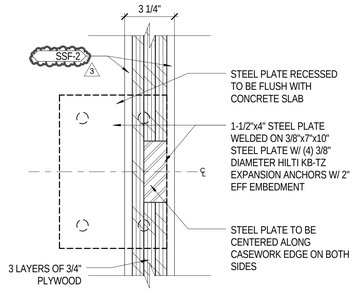
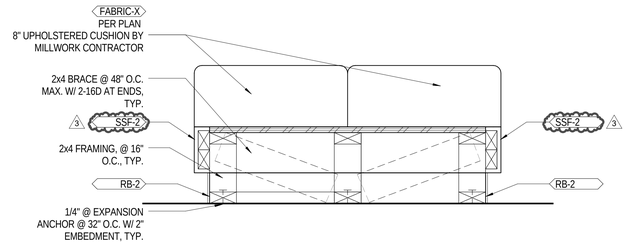
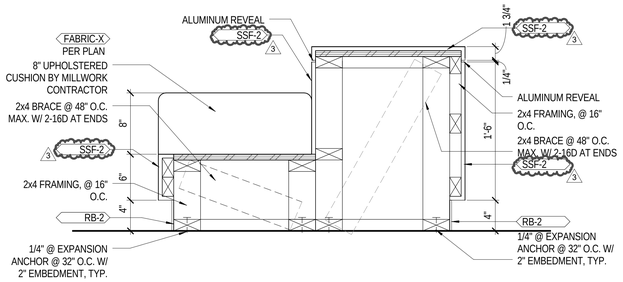


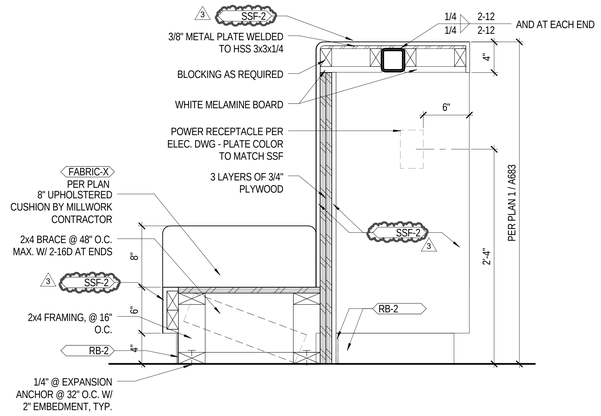
11 STEEL BASE PLATE PLAN DETAIL AT SOFT-SEAT BENCH, TYP.
3" = 1'-0"



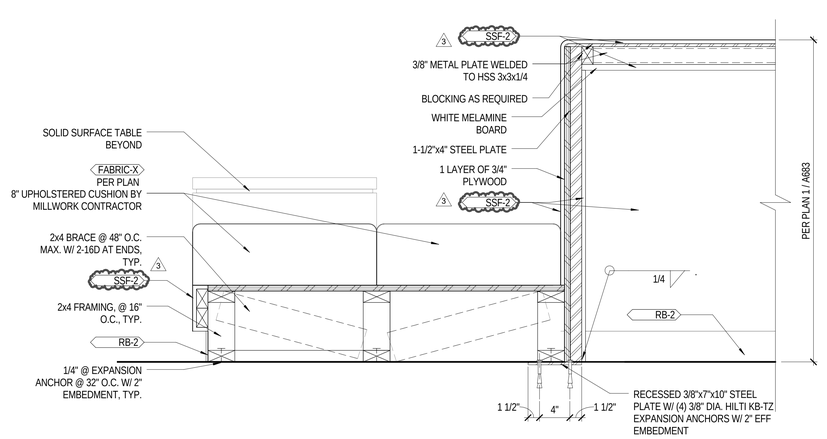
10 SOFT-SEAT BENCH @ CORRIDOR - SECTION 4
1 1/2" = 1'-0"



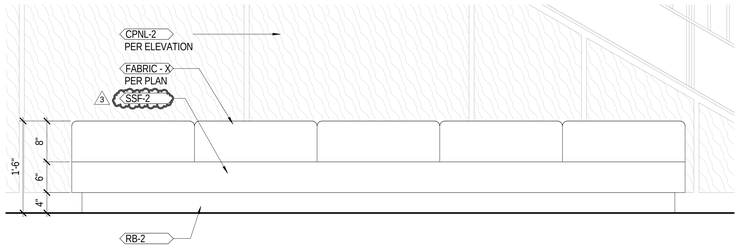
9 SOFT-SEAT BENCH @ CORRIDOR - SECTION 3
1 1/2" = 1'-0"



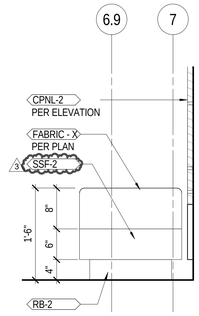
8 SOFT-SEAT BENCH @ CORRIDOR - SECTION 2
1 1/2" = 1'-0"



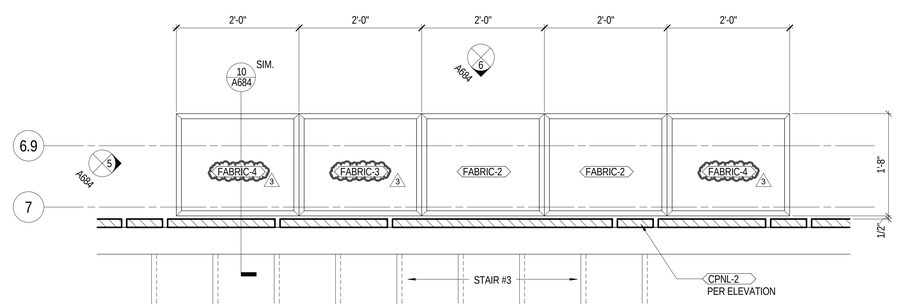
7 SOFT-SEAT BENCH @ CORRIDOR- SECTION 1
1 1/2" = 1'-0"



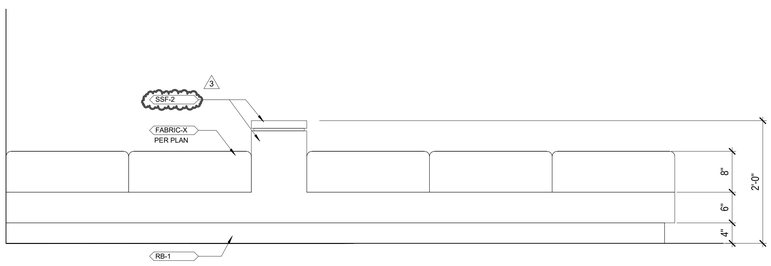
6 SOFT-SEAT BENCH @ CORRIDOR - ELEVATION 1
1" = 1'-0"



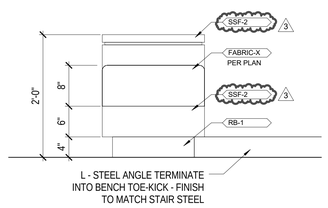
5 SOFT-SEAT BENCH @ CORRIDOR- ELEVATION 2
1" = 1'-0"



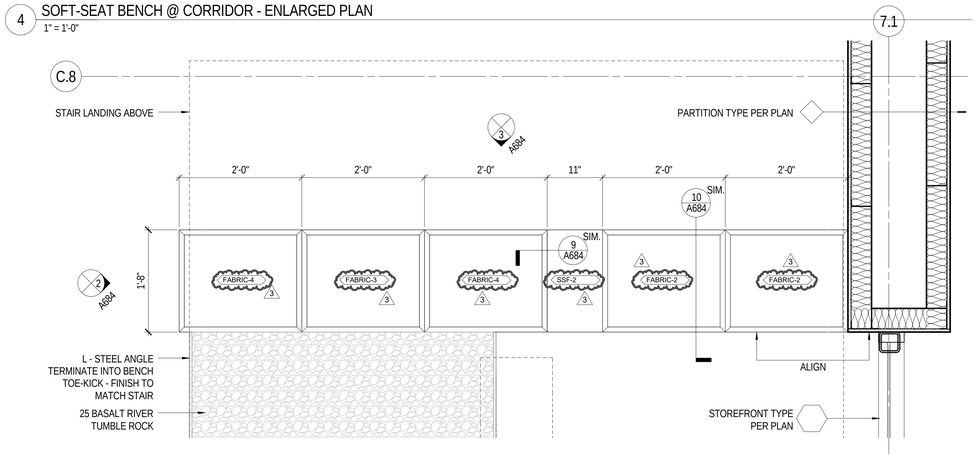
4 SOFT-SEAT BENCH @ CORRIDOR - ENLARGED PLAN
1" = 1'-0"



3 SOFT-SEAT BENCH @ LOBBY - ELEVATION 1
1" = 1'-0"



2 SOFT-SEAT BENCH @ LOBBY - ELEVATION 2
1" = 1'-0"



1 SOFT-SEAT BENCH @ LOBBY - ENLARGED PLAN
1" = 1'-0"

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JAMES G. MATSON — LICENSED ARCHITECT — REGISTERED PROFESSIONAL ENGINEER — SEPTEMBER 30, 2019 — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

CASEWORK IN COLLABORATION AND CORRIDORS

DATE: JULY 06, 2017

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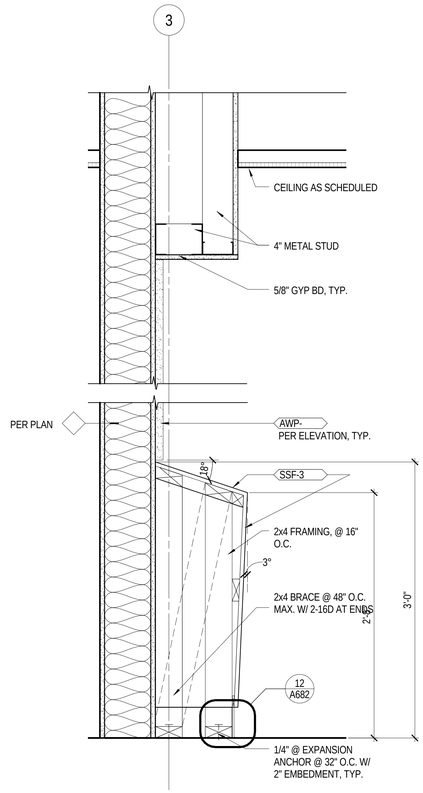
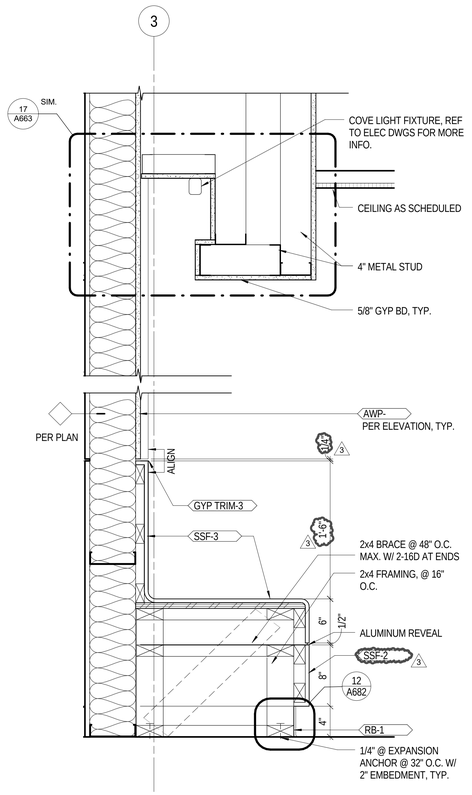
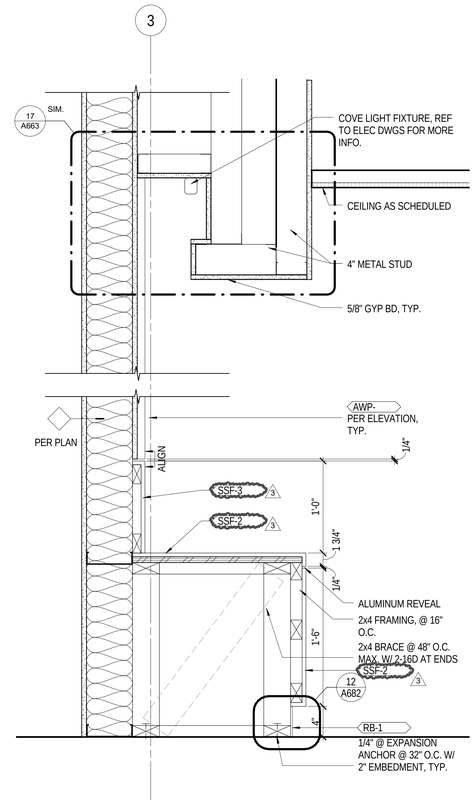


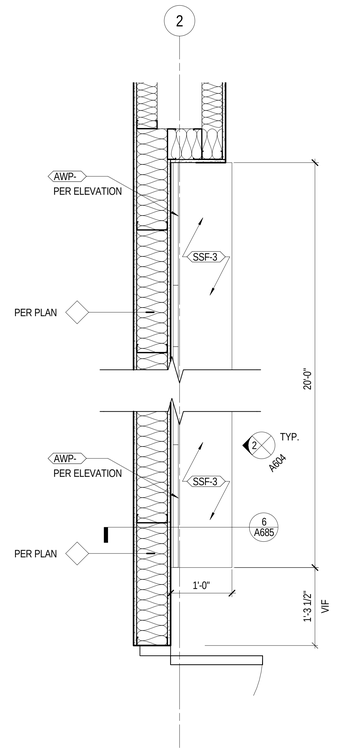
6 SECTION @ BUILT-IN PERCH
1 1/2" = 1'-0"



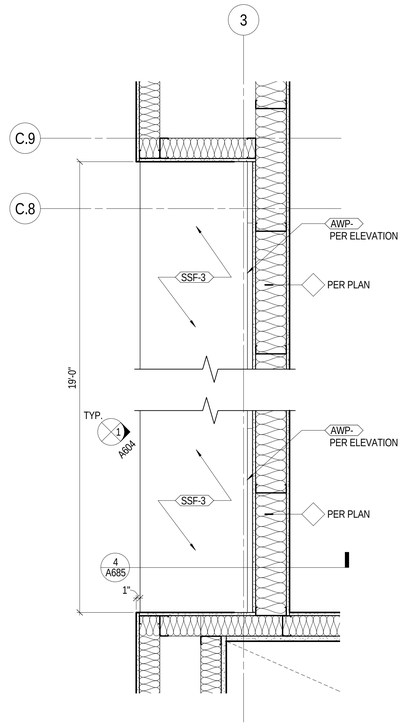
4 SECTION @ BUILT-IN BENCH
1 1/2" = 1'-0"



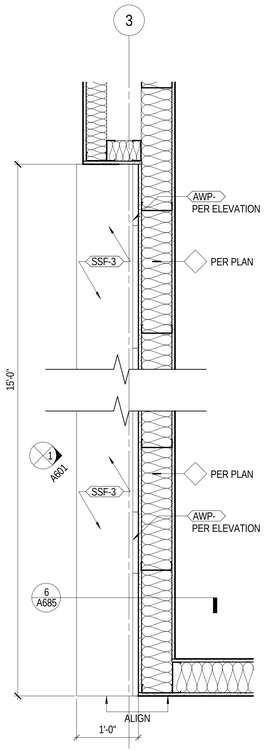
2 SECTION @ BUILT-IN TABLE
1 1/2" = 1'-0"



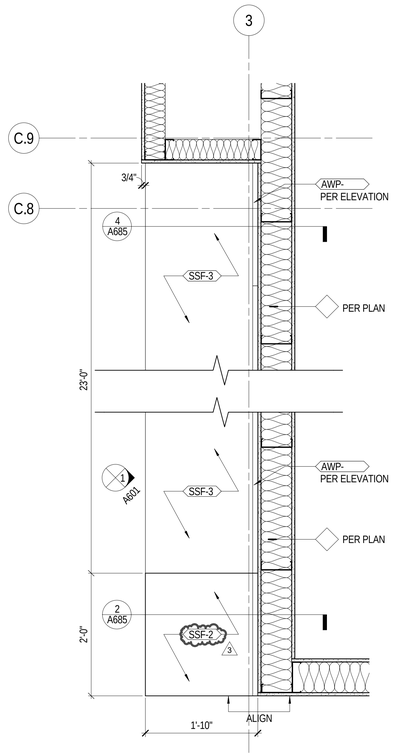
7 PLAN DETAIL AT BUILT IN PERCH 2
1" = 1'-0"



5 PLAN DETAIL AT BUILT-IN BENCH 2
1" = 1'-0"



3 PLAN DETAIL AT PERCH 1
1" = 1'-0"



1 PLAN DETAIL AT BUILT-IN BENCH 1
1" = 1'-0"

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JAMES G. MATSON — LICENSED ARCHITECT — EXPIRATION DATE: SEPTEMBER 30, 2019

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: MS | REVIEW BY: Approver

HGA NO: 3584-001-00

CASEWORK IN COLLABORATION AND CORRIDORS

DATE: JULY 06, 2017

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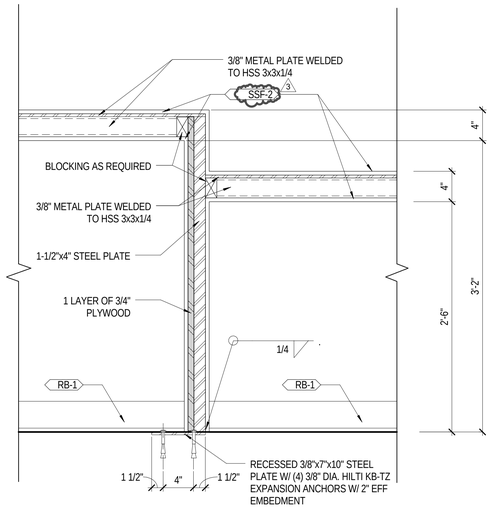
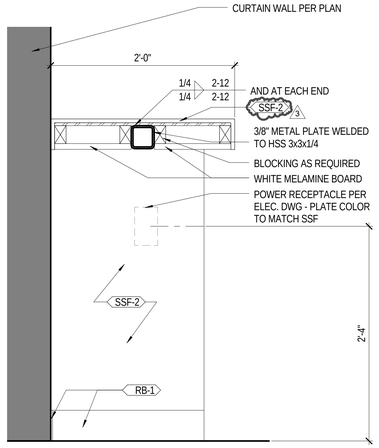
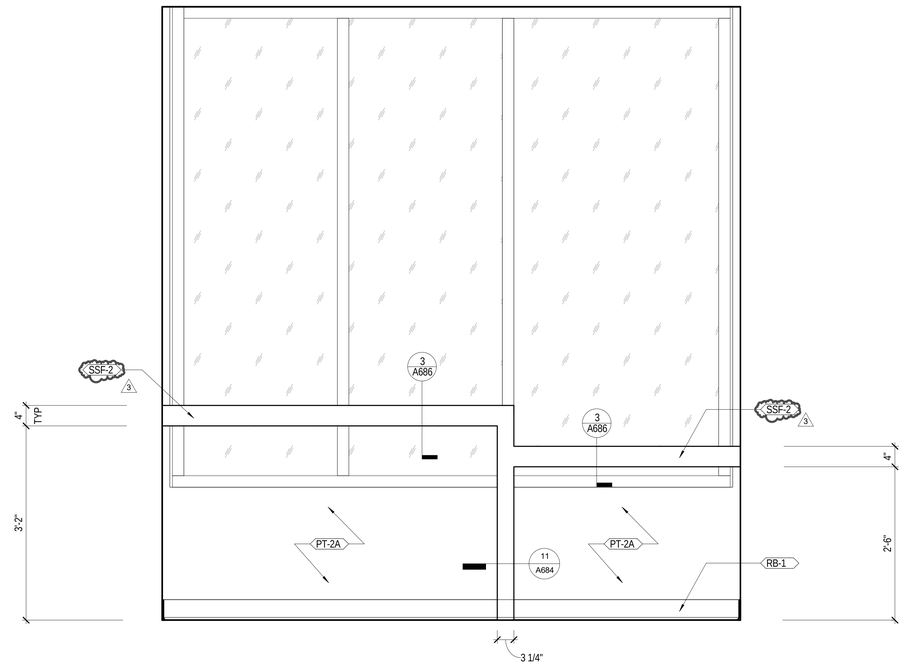


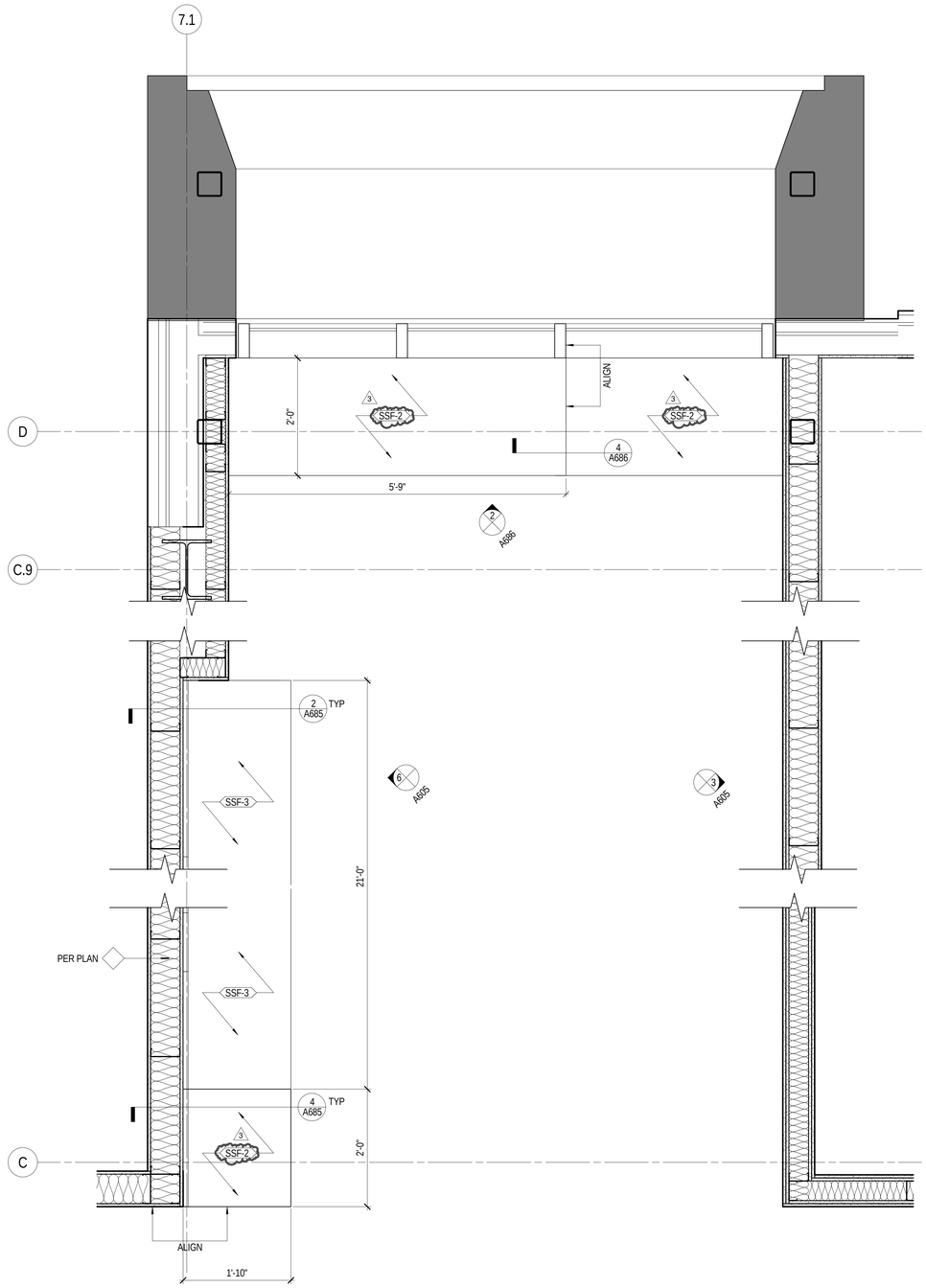
4 COUNTER SECTION 2
1 1/2" = 1'-0"



3 COUNTER SECTION 1
1 1/2" = 1'-0"



2 COLLABORATION COUNTER ELEVATION
1" = 1'-0"



1 ENLARGED PLAN AT COLLABORATION
1" = 1'-0"

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JAMES G. MATSON — LICENSED ARCHITECT — REGISTERED PROFESSIONAL ENGINEER — SEPTEMBER 30, 2019 — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

CASEWORK IN COLLABORATION AND CORRIDORS

DATE: JULY 06, 2017

A686

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1 Third Level - Sign Location Plan

Scale: 1/8" = 1'-0"

Symbol Legend

X.XX.X

- Level / Floor
- Sign No.
- Sign Type

Sign Legend

1	Primary Project I.D. Signage on Exterior Building Wall	0
2	Secondary Project I.D. Signage on Exterior Building Wall	0
3	Notice Sign / Symbol of Accessibility @ Building Entry	2
4	Building Directory @ First Floor Elevator Lobby	0
5	Floor Directory (Floors 2 & 3)	1
6	Corridor Directional Sign	6
7	(Not Used)	-
8	Tactile Classroom I.D. Sign	17
8A	Secondary Classroom I.D. Sign (Exterior)	0
9	Room I.D. Signs	21
9A	Room I.D. Signs (Exterior)	0
10	Conference Room Sign	0
11	Office I.D. Sign	7
12	Title 24 Restroom Sign	2
12A	Title 24 Restroom Sign (Unisex)	1
13	ADA Restroom Sign	3
13A	ADA Restroom Sign (Unisex)	1
14	Symbol of Accessibility on Restroom Stall Door	2
15	(Not Used)	-
16	Maximum Occupancy Sign	7
17	Tactile Exit I.D. Sign	0
18	Tactile Exit Route Sign	18
19	Stair Level I.D. Sign	3
20	Restroom I.D. Sign (Flag mount)	0
21	Assistive Listening Sign	7
22	Tactile Stair Level I.D. Sign	0
23	Evacuation Plan	2
23A	Evacuation Plan at Elevators	1
24	Fire Annunciator Sign	0
25	Gas Shut-Off Valve Sign	7
26	Fire Riser Room Sign	1

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JAMES G. MAZZEI — LICENSED ARCHITECT — No. C 26000 — EXPIRES: SEPTEMBER 30, 2017 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: NO

HGA NO: 3584-001-00

THIRD LEVEL SIGN LOCATION PLAN

DATE: JULY 06, 2017

GS.04

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NOTES SAC_ST1.01_Proj01-Canopy.ai

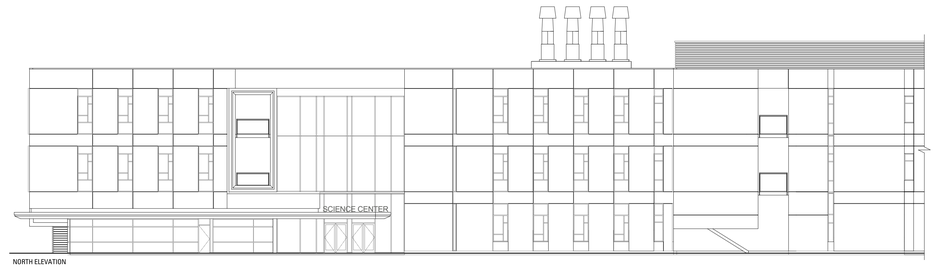
1 1" THK. FABRICATED ALUMINUM LETTERS WITH PAINT FINISH. LETTERS TO BE MECHANICALLY ATTACHED TO TOP OF CANOPY WITH ANCHOR PINS WITH 1 1/2" STANDOFF SPACERS.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" WITH MATTHEWS SATIN FINISH CLEAR COAT

2 DETAIL - SIGN NO. 1.01.1
SCALE: 1/2" = 1'-0"

3 DETAIL - SIGN NO. 1.01.1
SCALE: 1 1/2" = 1'-0"



NORTH ELEVATION

1 ELEVATION - SIGN TYPE 1 - SIGN NO. 1.01.1 - PRIMARY PROJECT ID SIGNAGE ON EXTERIOR BUILDING CANOPY
SCALE: 1/16" = 1'-0"

NOTES SAC_ST1.02_Proj01-Wall.ai

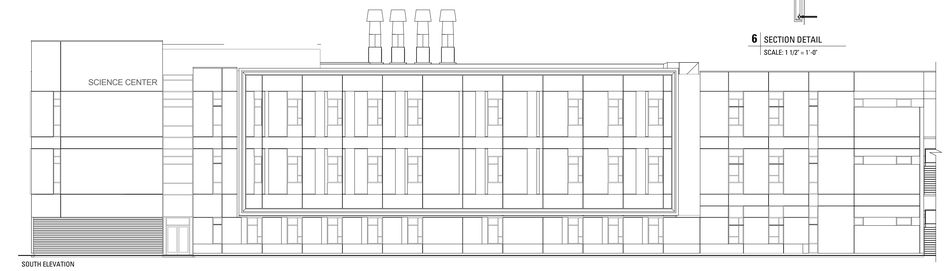
1 1" THK. FABRICATED ALUMINUM LETTERS WITH PAINT FINISH. LETTERS TO BE MECHANICALLY ATTACHED TO WALL WITH BLIND ANCHOR STUDS WITH 1/4" THK. STANDOFF SPACERS.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" WITH MATTHEWS SATIN FINISH CLEAR COAT

5 DETAIL - SIGN NO. 1.02.1
SCALE: 1/2" = 1'-0"

6 SECTION DETAIL
SCALE: 1 1/2" = 1'-0"



SOUTH ELEVATION

4 ELEVATION - SIGN TYPE 1 - SIGN NO. 1.02.1 - PRIMARY PROJECT ID SIGNAGE ON EXTERIOR BUILDING WALL
SCALE: 1/16" = 1'-0"

NOTES SAC_ST1.03_Proj01-Wall.ai

1 3/4" THK. FABRICATED ALUMINUM LETTERS WITH PAINT FINISH. LETTERS TO BE MECHANICALLY ATTACHED TO WALL WITH BLIND ANCHOR STUDS WITH 1/4" THK. STANDOFF SPACERS.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" WITH MATTHEWS SATIN FINISH CLEAR COAT

9 DETAIL - SIGN NO. 1.03.1
SCALE: 1/2" = 1'-0"

NORTH ELEVATION AT GREENHOUSE

8 SECTION DETAIL
SCALE: 1 1/2" = 1'-0"

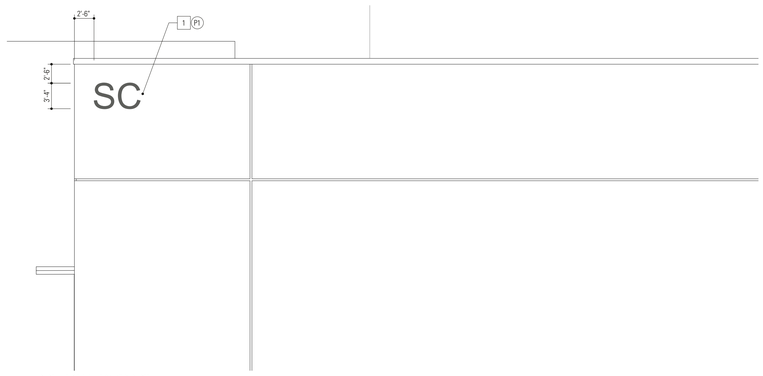
7 ELEVATION - SIGN TYPE 1 - SIGN NO. 1.03.1 - PRIMARY PROJECT ID SIGNAGE ON EXTERIOR BUILDING WALL
SCALE: 3/8" = 1'-0"

NOTES SAC_ST1.01_Proj01-Wall.ai

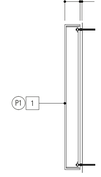
1 2" THK. FABRICATED ALUMINUM LETTERS WITH PAINT FINISH. LETTERS TO BE MECHANICALLY ATTACHED TO WALL WITH BLIND ANCHOR STUDS WITH 1/4" THK. STANDOFF SPACERS.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" WITH MATTHEWS SATIN FINISH CLEAR COAT



PARTIAL EAST ELEVATION AT PARAPET



11 SECTION DETAIL
SCALE: 1 1/2" = 1'-0"

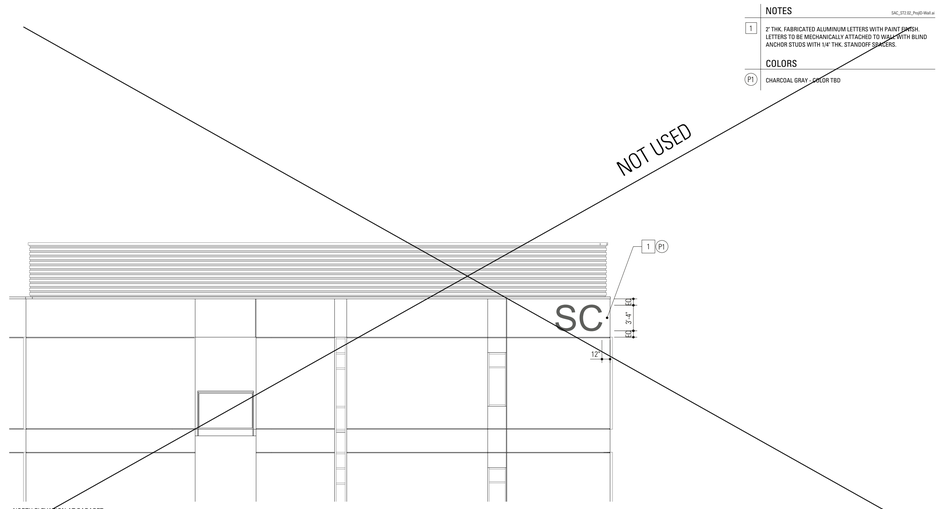
10 ELEVATION - SIGN TYPE 2 - SIGN NO. 2.01.1 - SECONDARY PROJECT ID SIGNAGE ON EXTERIOR BUILDING WALL
SCALE: 1/8" = 1'-0"

NOTES SAC_ST2.02_Proj01-Wall.ai

1 2" THK. FABRICATED ALUMINUM LETTERS WITH PAINT FINISH. LETTERS TO BE MECHANICALLY ATTACHED TO WALL WITH BLIND ANCHOR STUDS WITH 1/4" THK. STANDOFF SPACERS.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" WITH MATTHEWS SATIN FINISH CLEAR COAT



NORTH ELEVATION AT PARAPET

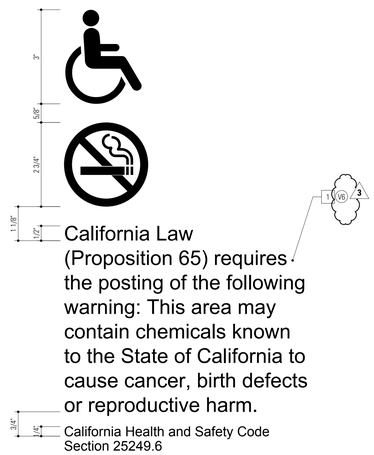
12 ELEVATION - SIGN TYPE 2 - SIGN NO. 2.02.1 - SECONDARY PROJECT ID SIGNAGE ON EXTERIOR BUILDING WALL
SCALE: 1/8" = 1'-0"

NOTES SAC_ST2.02_Proj01-Wall.ai

1 2" THK. FABRICATED ALUMINUM LETTERS WITH PAINT FINISH. LETTERS TO BE MECHANICALLY ATTACHED TO WALL WITH BLIND ANCHOR STUDS WITH 1/4" THK. STANDOFF SPACERS.

COLORS

P1 CHARCOAL GRAY - COLOR TBD



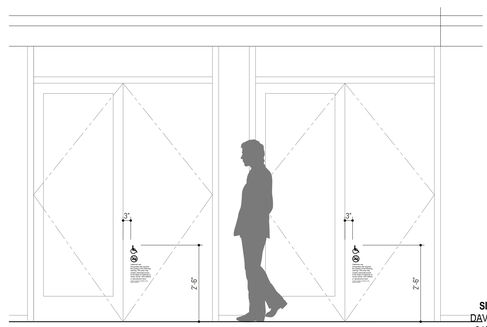
13 ELEVATION - SIGN TYPE 3 - NOTICE SIGN/SYMBOL OF ACCESSIBILITY AT BUILDING ENTRY
SCALE: HALF SCALE

NOTES SAC_ST3_Notice-AccSymbol.ai

1 APPLIED VINYL GRAPHICS.

COLORS

V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725



14 LOCATION ELEVATION AT MAIN ENTRY DOOR
SCALE: 1/2" = 1'-0"

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Telephone 310.557.7600

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SANTA ANA, CA 92706

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LICENSED ARCHITECT CHARLES G. MATTHEWS No. 18900 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

GS.06

ADDENDA PACKAGE

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DAVIES ASSOCIATES, INC.
9424 DAYTON WAY, #217
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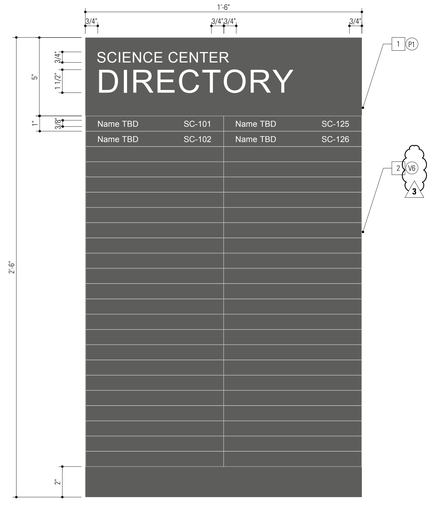
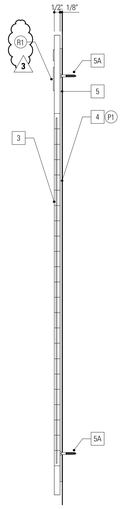
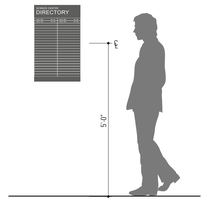


1 ELEVATION - SIGN TYPE 4 - BUILDING DIRECTORY AT FIRST FLOOR ELEVATOR LOBBY
SCALE: 3" = 1'-0"



2 SIDE VIEW
SCALE: 3"= 1'-0"



3 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_07A_BldgDir.ai

1 1/2" THK. ACRYLIC SIGN PANEL WITH 1/32" THK. LIGHT GRAY ROWMARK COPY ON HEADER WITH SATIN CLEAR OVERCOAT. SIGN PANEL TO HAVE PAINT FINISH ON ALL SIDES.

2 CLEAR ACETATE MESSAGE INSERTS WITH VINYL COPY AND MATTHEWS POLYURETHANE OVERCOAT.

3 MATTE ACRYLIC WINDOW FOR CHANGEABLE INSERT

4 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.

5 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED. USE STUDS IF NECESSARY.

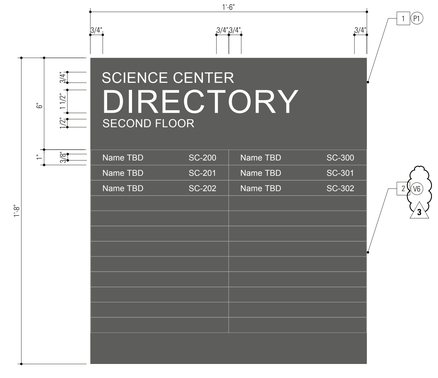
5A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

COLORS

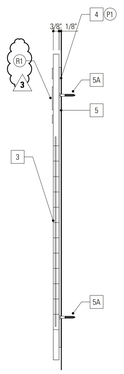
P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH

V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725

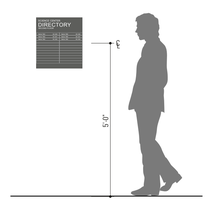
R1 ROWMARK "LIGHT GRAY" 3XI-305



4 ELEVATION - SIGN TYPE 5 - FLOOR DIRECTORY (FLOORS 2 & 3)
SCALE: 3" = 1'-0"



5 SIDE VIEW
SCALE: 3" = 1'-0"



6 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_07B_FlrDirectory.ai

1 1/2" THK. ACRYLIC SIGN PANEL WITH 1/32" THK. LIGHT GRAY ROWMARK COPY ON HEADER WITH SATIN CLEAR OVERCOAT. SIGN PANEL TO HAVE PAINT FINISH ON ALL SIDES.

2 CLEAR ACETATE MESSAGE INSERTS WITH VINYL COPY AND MATTHEWS POLYURETHANE OVERCOAT.

3 MATTE ACRYLIC WINDOW FOR CHANGEABLE INSERT

4 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.

5 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED. USE STUDS IF NECESSARY.

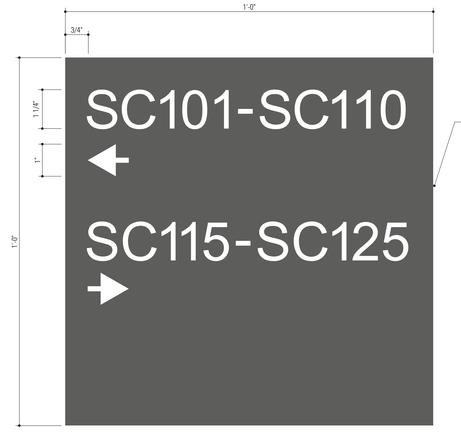
5A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH

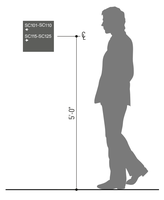
V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725

R1 ROWMARK "LIGHT GRAY" 3XI-305



7 ELEVATION - SIGN TYPE 6 - CORRIDOR DIRECTIONAL SIGN
SCALE: HALF

8 SIDE VIEW
SCALE: HALF



9 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_07B_GuDir.ai

1 1/8" THK. MATTE ACRYLIC SIGN PANEL WITH SUBSURFACE SILKSCREENED COPY.

2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.

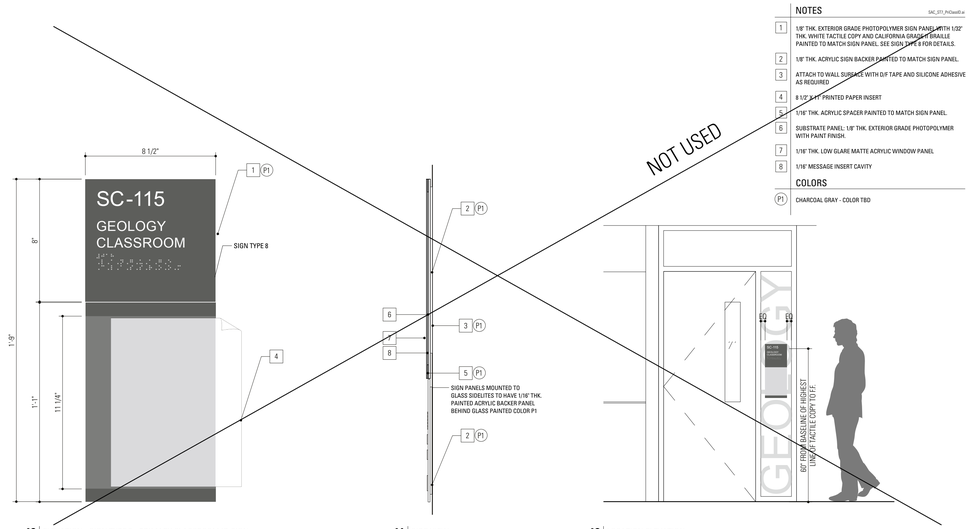
3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED.

3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

COLORS

P1 CHARCOAL GRAY - COLOR TBD

P2 MATTHEWS PAINT TO MATCH DUNN EDWARDS DEW382 "FADED GRAY" - SATIN FINISH



10 ELEVATION - SIGN TYPE 7 - PRIMARY CLASSROOM ID SIGN
SCALE: 3" = 1'-0"

11 SIDE VIEW
SCALE: 3" = 1'-0"

12 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_07C_FlrDirectory.ai

1 1/8" THK. EXTERIOR GRADE PHOTOPOLYMER SIGN PANEL WITH 1/32" THK. WHITE TACTILE COPY AND CALIFORNIA GRADE BRAILLE PAINTED TO MATCH SIGN PANEL. SEE SIGN TYPE 8 FOR DETAILS.

2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.

3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED

4 8 1/2" X 11" PRINTED PAPER INSERT

5 1/16" THK. ACRYLIC SPACER PAINTED TO MATCH SIGN PANEL

6 SUBSTRATE PANEL: 1/8" THK. EXTERIOR GRADE PHOTOPOLYMER WITH PAINT FINISH.

7 1/16" THK. LOW GLARE MATTE ACRYLIC WINDOW PANEL

8 1/16" MESSAGE INSERT CAVITY

COLORS

P1 CHARCOAL GRAY - COLOR TBD

NOTES SAC_07B_FlrDirectory.ai

1 1/8" THK. ACRYLIC SIGN PANEL WITH PAINT FINISH ON FACE AND EDGES AND 1/32" THK. TACTILE COPY AND CLEAR CALIFORNIA GRADE II BULLET BRAILLE WITH MATTHEWS PAINT SATIN FINISH CLEAR OVERCOAT.

2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.

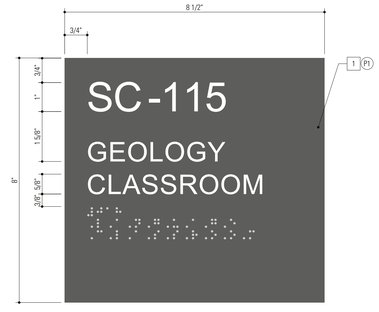
3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED

3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

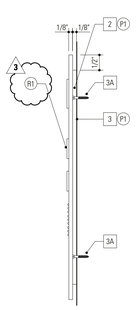
COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH

R1 ROWMARK "LIGHT GRAY" 3XI-305



13 ELEVATION - SIGN TYPE 8 - TACTILE CLASSROOM ID SIGN
SCALE:HALF



14 SIDE VIEW
SCALE: HALF

15 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_07B_FlrDirectory.ai

1 1/8" THK. ACRYLIC SIGN PANEL WITH PAINT FINISH ON FACE AND EDGES AND 1/32" THK. TACTILE COPY AND CLEAR CALIFORNIA GRADE II BULLET BRAILLE WITH MATTHEWS PAINT SATIN FINISH CLEAR OVERCOAT.

2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.

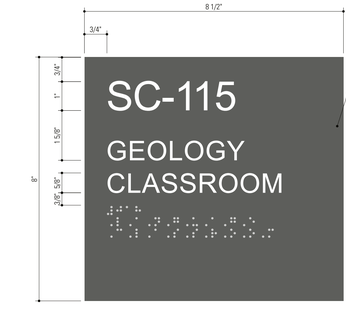
3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED

3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

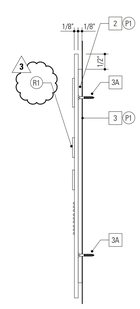
COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH

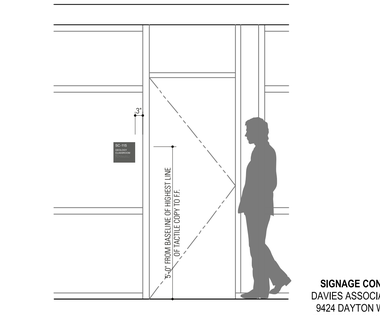
R1 ROWMARK "LIGHT GRAY" 3XI-305



17 ELEVATION - SIGN TYPE 8A - CLASSROOM ID SIGN (EXTERIOR)
SCALE: HALF



18 SIDE VIEW
SCALE: HALF



19 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

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NOEL A. DAVIES — LICENSED ARCHITECT — No. C-26000 — EXPIRES 08-31-2017 — STATE OF CALIFORNIA

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

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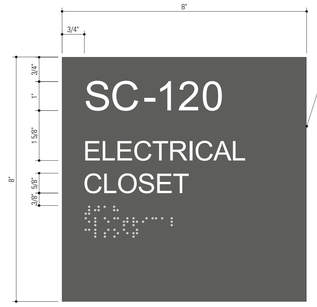
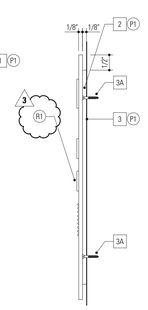
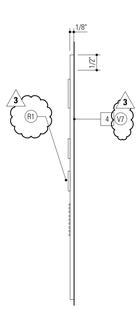


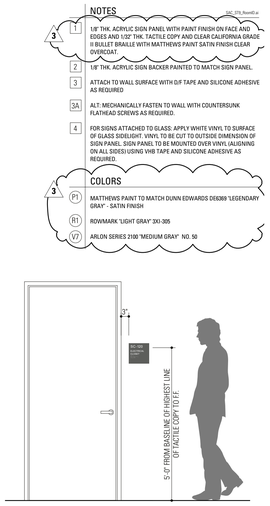
1 ELEVATION - SIGN TYPE 9 - ROOM ID SIGN
SCALE: HALF SIZE



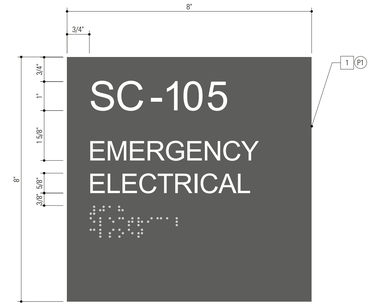
2 SIDE VIEW - WALL MOUNT
SCALE: HALF



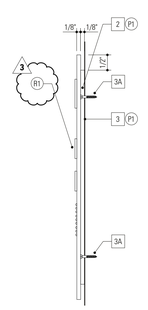
3 SIDE VIEW - GLASS MOUNT
SCALE: HALF



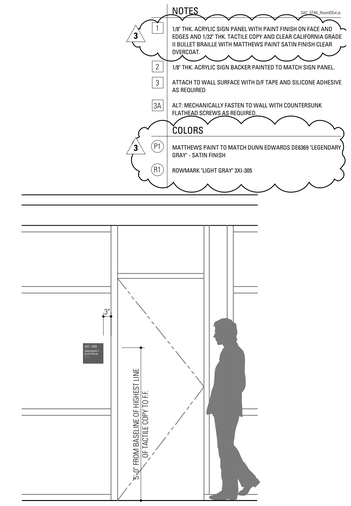
4 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"



5 ELEVATION - SIGN TYPE 9A - ROOM ID SIGN (EXTERIOR)
SCALE: HALF



6 SIDE VIEW
SCALE: HALF



7 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

8 ELEVATION - SIGN TYPE 10 - CONFERENCE ROOM SIGN
SCALE: HALF SIZE

9 SIDE VIEW
SCALE: HALF

10 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

11 ELEVATION - SIGN TYPE 11 - OFFICE ID SIGN
SCALE: HALF

12 SIDE VIEW
SCALE: HALF

13 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

14 ELEVATION - SIGN TYPE 12 - TITLE 24 RESTROOM SIGN
SCALE: 3" = 1'-0"

15 SIDE VIEW
SCALE: 3" = 1'-0"

16 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

17 ELEVATION - SIGN TYPE 12A - TITLE 24 RESTROOM SIGN (UNISEX)
SCALE: 3" = 1'-0"

18 SIDE VIEW
SCALE: 3" = 1'-0"

19 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

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NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

GS.08

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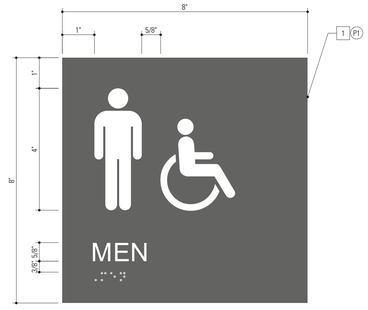
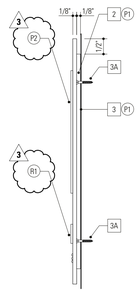
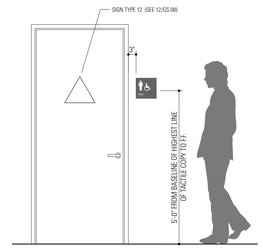
4 ELEVATION - SIGN TYPE 13 - ADA RESTROOM SIGN
SCALE: 3" = 1'-0"



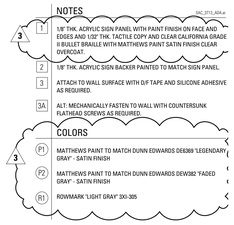
1 ELEVATION - SIGN TYPE 13 - ADA RESTROOM SIGN
SCALE: HALF

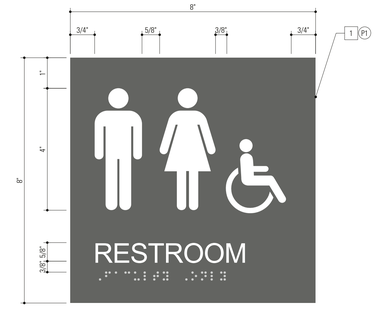


2 SIDE VIEW
SCALE: HALF

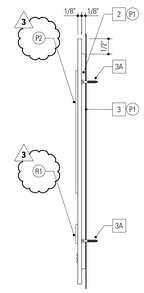


3 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

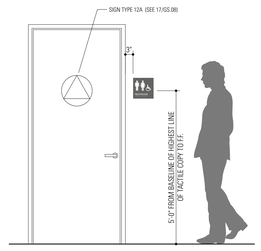




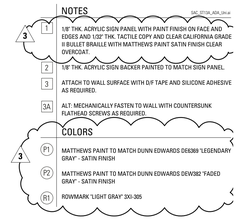
5 ELEVATION - SIGN TYPE 13A - ADA RESTROOM SIGN (UNISEX)
SCALE: HALF

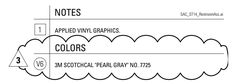


6 SIDE VIEW
SCALE: HALF

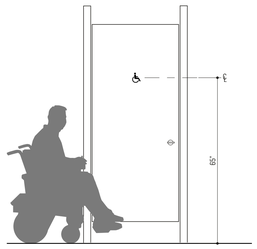


7 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

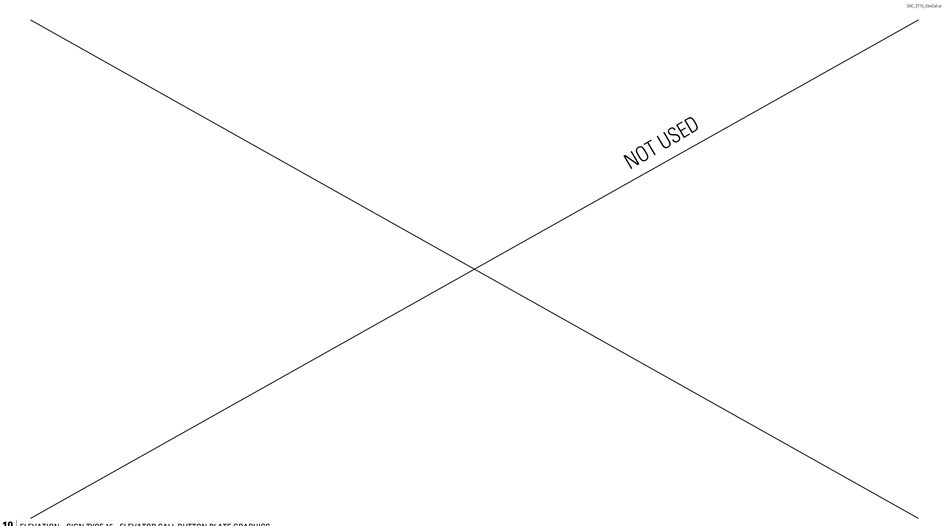




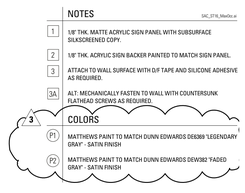
8 ELEVATION - SIGN TYPE 14 - SYMBOL OF ACCESSIBILITY ON RESTROOM STALL DOOR
SCALE: HALF



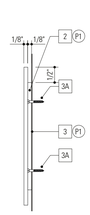
9 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"



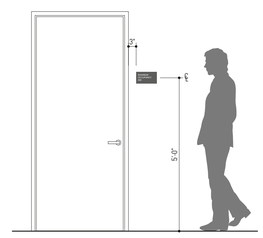
10 ELEVATION - SIGN TYPE 15 - ELEVATOR CALL BUTTON PLATE GRAPHICS
SCALE: 1/4" = 1'-0"



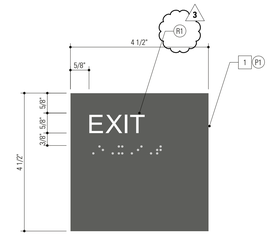
11 ELEVATION - SIGN TYPE 16 - MAXIMUM OCCUPANCY SIGN
SCALE: HALF



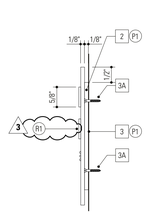
12 SIDE VIEW
SCALE: HALF



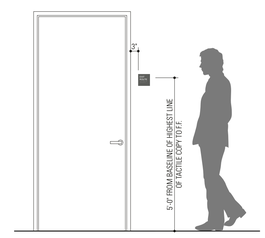
13 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"



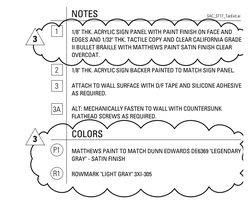
14 ELEVATION - SIGN TYPE 17 - TACTILE EXIT ID SIGN
SCALE: HALF



15 SIDE VIEW
SCALE: HALF



16 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"



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SANTA ANA, CA 92706

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

NOEL G. MATTHEWS — LICENSED ARCHITECT — No. C-29277 — EXPIRES 08-31-2017 — STATE OF CALIFORNIA

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

GS.09

ADDENDA PACKAGE

SIGNAGE CONSULTANT
DAVIES ASSOCIATES, INC.
9424 DAYTON WAY, #217
BEVERLY HILLS, CA 90210
310-247-9572

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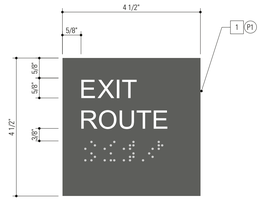
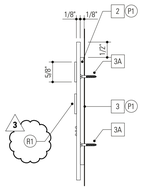
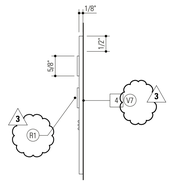


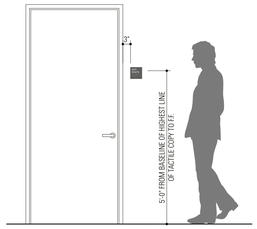
1 ELEVATION - SIGN TYPE 18 - TACTILE EXIT ROUTE SIGN
SCALE: HALF



2 SIDE VIEW - WALL MOUNT
SCALE: HALF



3 SIDE VIEW - GLASS MOUNT
SCALE: HALF



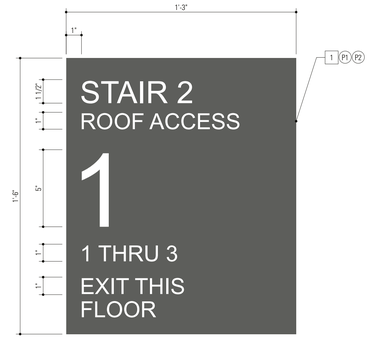
4 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_0718_TactExitRte.ai

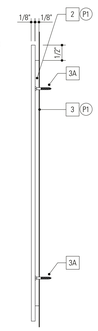
3
1 1/8" THK. ACRYLIC SIGN PANEL WITH PAINT FINISH ON FACE AND EDGES AND 1/32" THK. TACTILE COPY AND CLEAR CALIFORNIA GRADE II BULLET BRAILLE WITH MATTHEWS PAINT SATIN FINISH CLEAR OVERCOAT.
2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.
3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED.
3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.
4 FOR SIGNS ATTACHED TO GLASS, APPLY ARLON "MEDIUM GRAY" V6 VINYL TO SURFACE OF GLASS (SIDELIGHT. VINYL TO BE CUT TO OUTSIDE DIMENSION OF SIGN PANEL. SIGN PANEL TO BE MOUNTED OVER VINYL (ALIGNING ON ALL SIDES) USING VHB TAPE AND SILICONE ADHESIVE AS REQUIRED.

COLORS
3
P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH
V7 ARLON SERIES 2100 "MEDIUM GRAY" NO. 50
R1 ROWMARK "LIGHT GRAY" 3XI-305

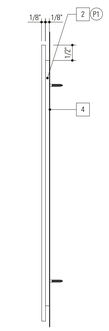
SCALE: 1 1/2" = 1'-0"



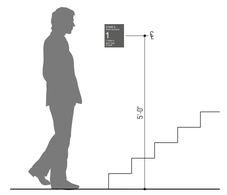
5 ELEVATION - SIGN TYPE 19 - STAIR LEVEL ID SIGN
SCALE: 3" = 1'-0"



6 SIDE VIEW - WALL MOUNT
SCALE: 3" = 1'-0"



7 SIDE VIEW - CORRUGATED METAL MOUNT
SCALE: 3" = 1'-0"



8 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

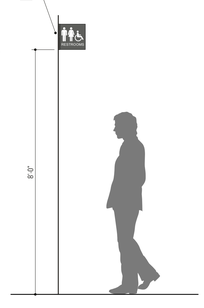
NOTES SAC_0718_RestroomID-Flag.ai

1 1/8" THK. MATTE ACRYLIC SIGN PANEL WITH SUBSURFACE SILKSCREENED COPY.
2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.
3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED.
3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.
4 MECHANICALLY MOUNT BACKER PANEL TO CORRUGATED METAL SURFACE WITH SCREWS.

COLORS
3
P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH
P2 MATTHEWS PAINT TO MATCH DUNN EDWARDS DEW382 "FADED GRAY" - SATIN FINISH

10 PLAN VIEW
SCALE: HALF SIZE

8 ELEVATION - SIGN TYPE 20 - RESTROOM ID (FLAG SIGN) - DOUBLE SIDED
SCALE: HALF SIZE



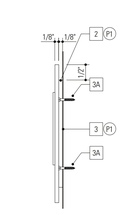
9 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_0718_RestroomID-Flag.ai

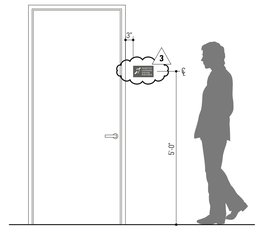
1 ANNODIZED ALUMINUM CHANNEL BRACKET WITH PAINT FINISH.
2 1/16" THK. CLEAR MATTE ACRYLIC WITH PAINT FINISH ON SECOND SURFACE AND APPLIED VINYL GRAPHICS.
3 TAMPER PROOF HARDWARE
4 INSTALL FLUSH TO SURFACE WITH STUDS AND SILICONE ADHESIVE AS REQUIRED.

COLORS
3
P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH
V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725

11 ELEVATION - SIGN TYPE 21 - ASSISTIVE LISTENTING SIGN
SCALE: HALF



12 SIDE VIEW
SCALE: HALF

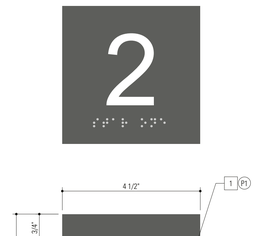


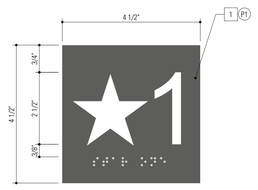
13 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_0721_AsstListening_Options.ai

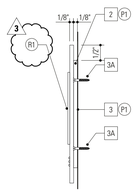
3
1 1/8" THK. ACRYLIC SIGN PANEL WITH PAINT FINISH ON FACE AND EDGES, APPLIED VINYL COPY AND MATTHEWS PAINT SATIN FINISH CLEAR OVERCOAT.
2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.
3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED.
3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

COLORS
3
P1 CHARCOAL GRAY - COLOR TBD
V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725

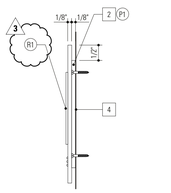




14 ELEVATION - SIGN TYPE 22 - TACTILE STAIR LEVEL ID SIGN
SCALE: HALF



15 SIDE VIEW - WALL MOUNT
SCALE: HALF

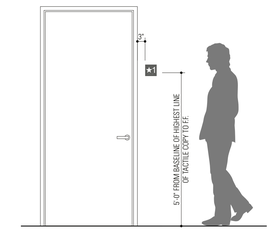


16 SIDE VIEW - CORRUGATED METAL MOUNT
SCALE: HALF

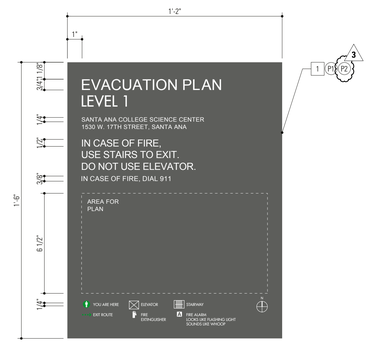
NOTES SAC_0723_TactSeatLetID.ai

3
1 1/8" THK. ACRYLIC SIGN PANEL WITH PAINT FINISH ON FACE AND EDGES AND 1/32" THK. TACTILE COPY AND CLEAR CALIFORNIA GRADE II BULLET BRAILLE WITH MATTHEWS PAINT SATIN FINISH CLEAR OVERCOAT.
2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.
3 ATTACH TO WALL SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED.
3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.
4 MECHANICALLY MOUNT BACKER PANEL TO CORRUGATED METAL SURFACE WITH SCREWS.

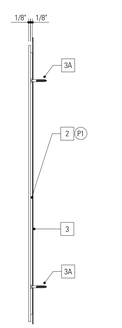
COLORS
3
P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH
R1 ROWMARK "LIGHT GRAY" 3XI-305



17 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"



17 ELEVATION - SIGN TYPE 23 -EVACUATION PLAN
SCALE: 3" = 1'-0"



18 SIDE VIEW
SCALE: 3" = 1'-0"

19 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

NOTES SAC_0723_Evac.ai

1 1/8" THK. MATTE LOW-GLARE ACRYLIC FACE WITH SUBSURFACE SILKSCREENED FULL COLOR GRAPHICS.
2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.
3 ATTACH TO SURFACE WITH D/F TAPE AND SILICONE ADHESIVE AS REQUIRED.
3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

COLORS
3
P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH
P2 MATTHEWS PAINT TO MATCH DUNN EDWARDS DEW382 "FADED GRAY" - SATIN FINISH

EVACUATION MAP ARTWORK TO BE PROVIDED BY SIGN CONTRACTOR

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SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

GS.10

ADDENDA PACKAGE

SIGNAGE CONSULTANT
DAVIES ASSOCIATES, INC.
9424 DAYTON WAY, #217
BEVERLY HILLS, CA 90210
310-247-9572

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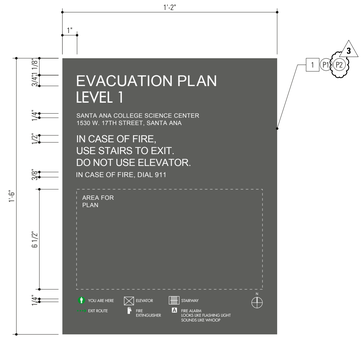
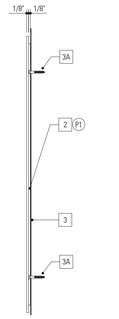


1 ELEVATION - SIGN TYPE 23A - EVACUATION PLAN AT ELEVATOR

SCALE: 3" = 1'-0"



2 SIDE VIEW

SCALE: 3" = 1'-0"

3 LOCATION ELEVATION

SCALE: 1/2" = 1'-0"

NOTES SAC_ST23A_Exec Elev.ai

1 1/8" THK. MATTE LOW-GLARE ACRYLIC FACE WITH SUBSURFACE SILKSCREENED FULL COLOR GRAPHICS.

2 1/8" THK. ACRYLIC SIGN BACKER PAINTED TO MATCH SIGN PANEL.

3 ATTACH TO SURFACE WITH DJF TAPE AND SILICONE ADHESIVE AS REQUIRED.

3A ALT: MECHANICALLY FASTEN TO WALL WITH COUNTERSUNK FLATHEAD SCREWS AS REQUIRED.

COLORS

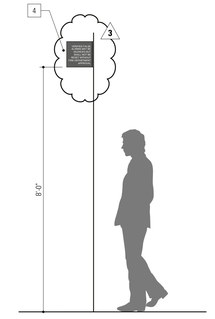
P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH

P2 MATTHEWS PAINT TO MATCH DUNN EDWARDS DEW382 "FADED GRAY" - SATIN FINISH

EVACUATION MAP ARTWORK TO BE PROVIDED BY SIGN CONTRACTOR

4 ELEVATION - SIGN TYPE 24 - FIRE ANNUNCIATOR (FLAG SIGN) - DOUBLE SIDED

SCALE: HALF SIZE



5 LOCATION ELEVATION

SCALE: 1/2" = 1'-0"

NOTES SAC_ST24_Fire Elev Flag.ai

1 ANNODIZED ALUMINUM CHANNEL BRACKET WITH PAINT FINISH.

2 1/16" THK. CLEAR MATTE ACRYLIC WITH PAINT FINISH ON SECOND SURFACE AND APPLIED VINYL GRAPHICS.

3 TAMPER PROOF HARDWARE

4 INSTALL FLUSH TO SURFACE WITH STUDS AND SILICONE ADHESIVE AS REQUIRED.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH

V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725

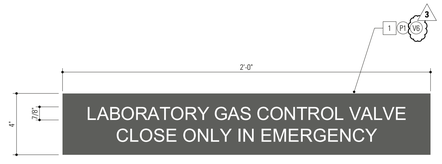
NOTES SAC_ST25_GasShutOff.ai

1 1/16" THK. ACRYLIC PANEL WITH PAINT FINISH. SIGN PANEL TO BE ADHERED TO CONTROL PANEL DOOR WITH VHB TAPE AND ADHESIVE AS REQUIRED.

COLORS

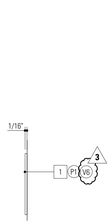
P1 CHARCOAL GRAY - COLOR TBD

V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725



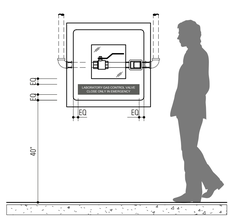
7 ELEVATION - SIGN TYPE 25 - GAS SHUT OFF SIGN

SCALE: 3" = 1'-0"



8 SIDE VIEW

SCALE: HALF



9 LOCATION ELEVATION

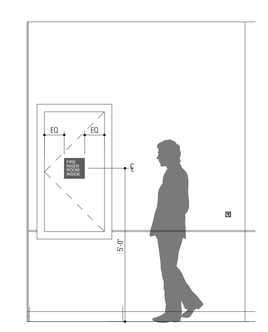
SCALE: 1/2" = 1'-0"

10 ELEVATION - SIGN TYPE 26 - FIRE RISER ROOM SIGN

SCALE: HALF

11 SIDE VIEW

SCALE: HALF



12 LOCATION ELEVATION

SCALE: 1/2" = 1'-0"

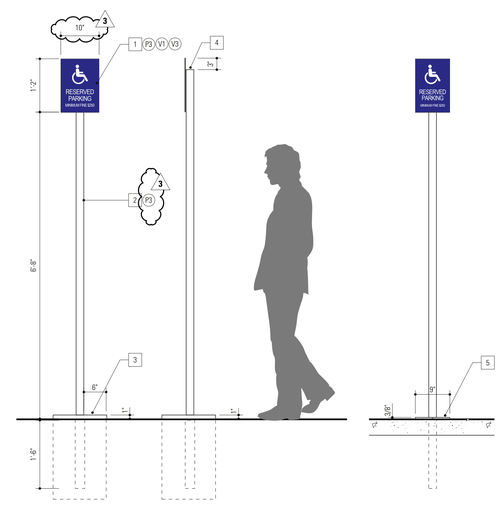
NOTES SAC_ST26_FireRiser.ai

1 1/16" THK. ACRYLIC PANEL WITH PAINT FINISH. SIGN PANEL TO BE ADHERED TO CONTROL PANEL DOOR WITH VHB TAPE AND ADHESIVE AS REQUIRED.

COLORS

P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6369 "LEGENDARY GRAY" - SATIN FINISH

V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725

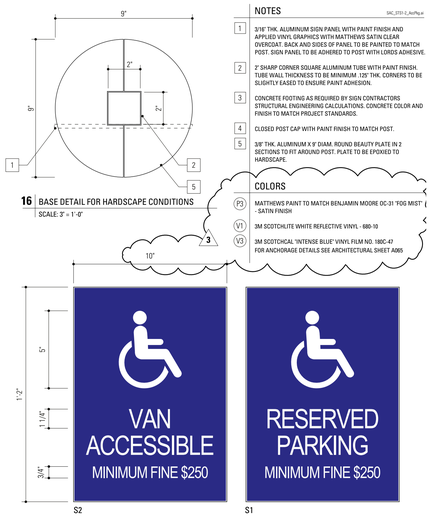


13 ELEVATION - SIGN TYPE S1 - ACCESSIBLE PARKING STALL SIGNS - LANDSCAPE CONDITION

SCALE: 3/4" = 1'-0"

14 HARDSCAPE CONDITION

SCALE: 3/4" = 1'-0"



15 DETAIL - SIGN TYPES S1 & S2

SCALE: 3" = 1'-0"

NOTES SAC_ST23-2_AccPkg.ai

1 3/16" THK. ALUMINUM SIGN PANEL WITH PAINT FINISH AND APPLIED VINYL GRAPHICS WITH MATTHEWS SATIN CLEAR OVERCOAT. BACK AND SIDES OF PANEL TO BE PAINTED TO MATCH POST. SIGN PANEL TO BE ADHERED TO POST WITH LORDS ADHESIVE.

2 2" SHARP CORNER SQUARE ALUMINUM TUBE WITH PAINT FINISH. TUBE WALL THICKNESS TO BE MINIMUM .125" THK. CORNERS TO BE SLIGHTLY EASED TO ENSURE PAINT ADHESION.

3 CONCRETE FOOTING AS REQUIRED BY SIGN CONTRACTORS STRUCTURAL ENGINEERING CALCULATIONS. CONCRETE COLOR AND FINISH TO MATCH PROJECT STANDARDS.

4 CLOSED POST CAP WITH PAINT FINISH TO MATCH POST.

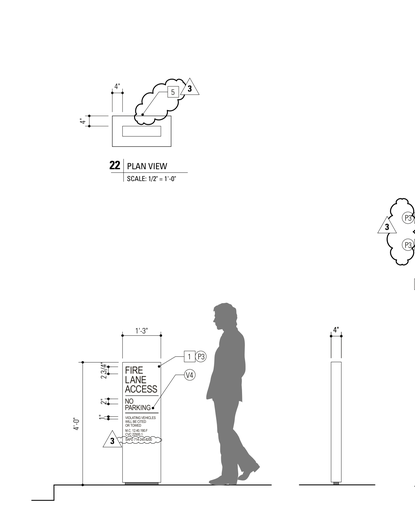
5 3/8" THK. ALUMINUM X 9" DIAM. ROUND BEAUTY PLATE IN 2 SECTIONS TO FIT AROUND POST. PLATE TO BE EPOXIED TO HARDSCAPE.

COLORS

P3 MATTHEWS PAINT TO MATCH BENJAMIN MOORE OC-31 "FOG MIST" - SATIN FINISH

V1 3M SCOTCHLITE WHITE REFLECTIVE VINYL - 680-10

V3 3M SCOTCHCAL "INTENSE BLUE" VINYL FILM NO. 1080-47 FOR ANCHORAGE DETAILS SEE ARCHITECTURAL SHEET A065



17 ELEVATION - SIGN TYPE S3 - FIRE LANE ACCESS SIGN

SCALE: 1/2" = 1'-0"

18 SIDE ELEVATION

SCALE: 1" = 1'-0"

19 SECTION DETAIL - LANDSCAPE

SCALE: 1" = 1'-0"

20 SECTION/DETAIL - HARDSCAPE

SCALE: 1" = 1'-0"

21 PARTIAL SIGN ELEVATION/COPY DETAIL

SCALE: 1 1/2" = 1'-0"

NOTES SCTC_ST20_FireLane.ai

1 .125 THICK FABRICATED ALUMINUM CABINET WITH PAINT FINISH AND APPLIED VINYL GRAPHICS WITH MATTHEWS CLEAR ACRYLIC POLYURETHANE FINISH COAT. WELD, GRIND AND SAND SMOOTH ALL JOINTS PRIOR TO PAINTING.

2 FLUSH/COUNTERSUNK SCREWS PAINTED TO MATCH SURROUNDING METAL.

3 INTERNAL STRUCTURAL VERTICAL SUPPORT AND/OR STRUCTURAL FRAMING AS REQUIRED.

4 3/4" HIGH BASE REVEAL.

5 4" CONTINUOUS CONCRETE MOW STRIP WITH EASED EDGES. COLOR AND FINISH OF CONRETE TO MATCH PROJECT STANDARDS.

P3 MATTHEWS PAINT TO MATCH BENJAMIN MOORE OC-31 "FOG MIST" - SATIN FINISH

V4 3M SCOTCHLITE "BLACK" REFLECTIVE VINYL FILM NO. 680-85

SIGNAGE CONSULTANT
DAVIES ASSOCIATES, INC.
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hGA.
1918 Main Street, Third Floor
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155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE

RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

NOEL G. DAVIES — No. C-18211 — REGISTERED ARCHITECT — SEPTEMBER 30, 2017 — RENEWAL DATE — STATE OF CALIFORNIA

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

GS.11

ADDENDA PACKAGE

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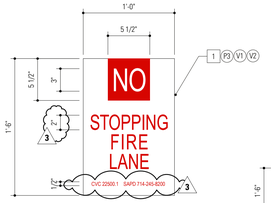
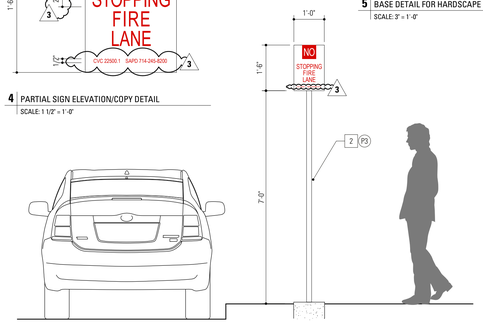
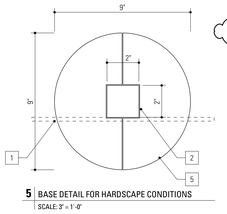


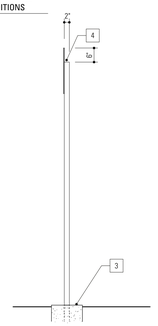
4 PARTIAL SIGN ELEVATION/COPY DETAIL
SCALE: 1 1/2" = 1'-0"



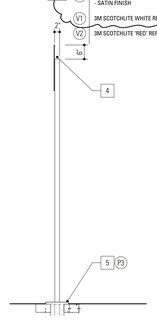
1 ELEVATION - SIGN TYPE 3A - NO STOPPING FIRE LANE SIGN - POST MOUNTED
SCALE: 1/2" = 1'-0"



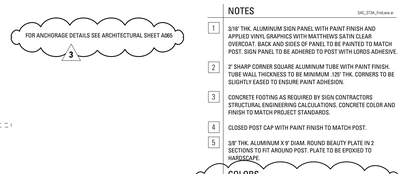
5 BASE DETAIL FOR HARDSCAPE CONDITIONS
SCALE: 3" = 1'-0"



2 SIDE VIEW - LANDSCAPE CONDITION
SCALE: 1/2" = 1'-0"



3 SIDE VIEW - HARDSCAPE CONDITION
SCALE: 1/2" = 1'-0"

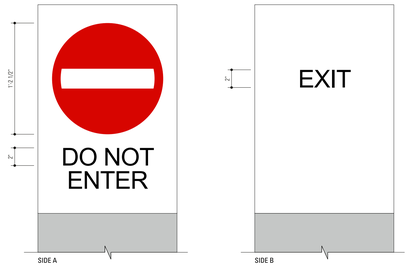


NOTES SAC_ST3A_Fnd.ane.ai

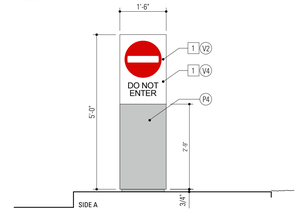
1. 3/16" THK. ALUMINUM SIGN PANEL WITH PAINT FINISH AND APPLIED VINYL GRAPHICS WITH MATTHEWS SATIN CLEAR OVERCOAT. BACK AND SIDES OF PANEL TO BE PAINTED TO MATCH POST. SIGN PANEL TO BE ADHERED TO POST WITH LORDS ADHESIVE.
2. 2" SHARP CORNER SQUARE ALUMINUM TUBE WITH PAINT FINISH. TUBE WALL THICKNESS TO BE MINIMUM .125" THK. CORNERS TO BE SLIGHTLY EASED TO ENSURE PAINT ADHESION.
3. CONCRETE FOOTING AS REQUIRED BY SIGN CONTRACTORS STRUCTURAL ENGINEERING CALCULATIONS. CONCRETE COLOR AND FINISH TO MATCH PROJECT STANDARDS.
4. CLOSED POST CAP WITH PAINT FINISH TO MATCH POST.
5. 3/8" THK. ALUMINUM X 9" DIAM. ROUND BEAUTY PLATE IN 2 SECTIONS TO FIT AROUND POST. PLATE TO BE EPOXIED TO HARDSCAPE.

COLORS

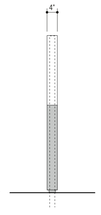
- P3 MATTHEWS PAINT TO MATCH BENJAMIN MOORE OC-31 "FOG MIST" - SATIN FINISH
- V1 3M SCOTCHLITE WHITE REFLECTIVE VINYL - 680-10
- V2 3M SCOTCHLITE "RED" REFLECTIVE VINYL FILM NO. 680-72



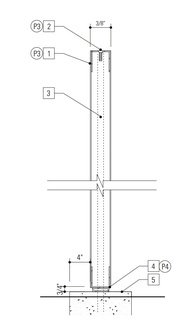
9 PARTIAL SIGN ELEVATION/COPY DETAIL - SIGN TYPE S4
SCALE: 1 1/2" = 1'-0"



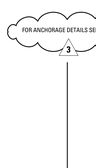
6 ELEVATION - SIGN TYPE S5 - EXIT/DO NOT ENTER SIGN
SCALE: 1/2" = 1'-0"



7 SIDE ELEVATION
SCALE: 1/2" = 1'-0"



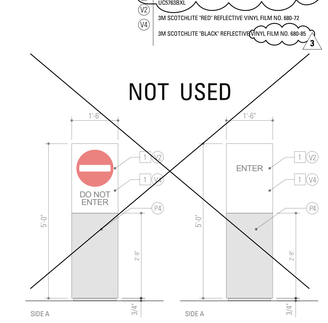
8 SECTION DETAIL - LANDSCAPE CONDITION
SCALE: 1" = 1'-0"



NOTES SCTC_ST11_DuNotEnter.ai

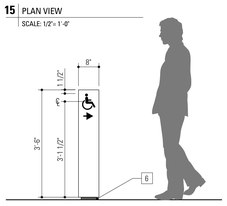
1. .125" THICK FABRICATED ALUMINUM CABINET WITH INTERNAL STRUCTURAL FRAMING AND PAINT FINISH. APPLIED VINYL GRAPHICS WITH MATTHEWS CLEAR ACRYLIC POLYURETHANE FINISH COAT. WELD, GRIND AND SAND SMOOTH ALL EXPOSED JOINTS PRIOR TO PAINTING.
2. FLUSH/COUNTERSUNK SCREWS PAINTED TO MATCH SURROUNDING METAL.
3. INTERNAL STRUCTURAL VERTICAL SUPPORT AND/OR STRUCTURAL FRAMING AS REQUIRED BY SIGN CONTRACTORS STRUCTURAL ENGINEERING CALCULATIONS.
4. 3/4" HIGH BASE REVEAL
5. 4" COUNTINUOUS CONCRETE MOW STRIP WITH EASED EDGES. COLOR AND FINISH OF CONCRETE TO MATCH PROJECT STANDARDS.

- P3 MATTHEWS PAINT TO MATCH BENJAMIN MOORE OC-31 "FOG MIST" - SATIN FINISH
- P4 MATTHEWS PAINT TO MATCH DURANAR "BRIGHT SILVER" UCS763BXL
- V2 3M SCOTCHLITE "RED" REFLECTIVE VINYL FILM NO. 680-72
- V4 3M SCOTCHLITE "BLACK" REFLECTIVE VINYL FILM NO. 680-85

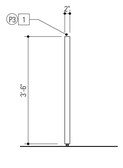


10 ELEVATION - SIGN TYPE S4 - DO NOT ENTER / ENTER SIGN
SCALE: 1/2" = 1'-0"

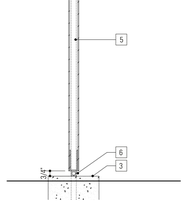
15 PLAN VIEW
SCALE: 1/2" = 1'-0"



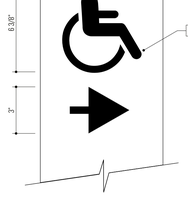
11 ELEVATION - SIGN TYPE S6 - ACCESSIBLE DIRECTIONAL
SCALE: 1/2" = 1'-0"



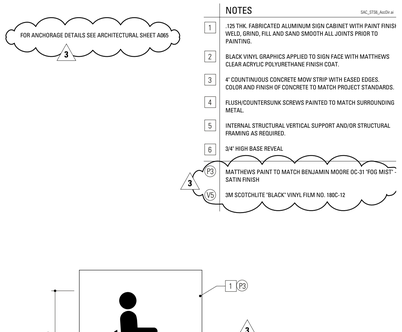
12 SIDE ELEVATION
SCALE: 1/2" = 1'-0"



13 SECTION DETAIL - LANDSCAPE CONDITION
SCALE: 1" = 1'-0"



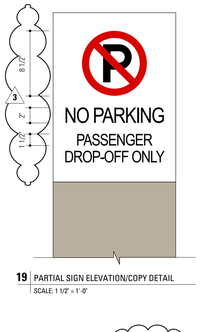
14 DETAIL
SCALE: 3" = 1'-0"



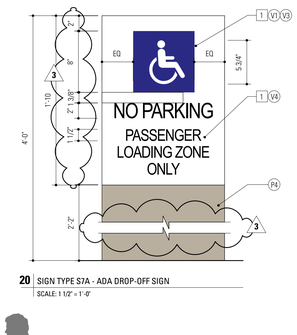
NOTES SAC_ST3A_Ax25.ai

1. .125 THK. FABRICATED ALUMINUM SIGN CABINET WITH PAINT FINISH WELD, GRIND, FILL AND SAND SMOOTH ALL JOINTS PRIOR TO PAINTING.
2. BLACK VINYL GRAPHICS APPLIED TO SIGN FACE WITH MATTHEWS CLEAR ACRYLIC POLYURETHANE FINISH COAT.
3. 4" COUNTINUOUS CONCRETE MOW STRIP WITH EASED EDGES. COLOR AND FINISH OF CONCRETE TO MATCH PROJECT STANDARDS.
4. FLUSH/COUNTERSUNK SCREWS PAINTED TO MATCH SURROUNDING METAL.
5. INTERNAL STRUCTURAL VERTICAL SUPPORT AND/OR STRUCTURAL FRAMING AS REQUIRED.
6. 3/4" HIGH BASE REVEAL

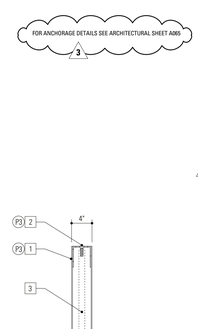
- P3 MATTHEWS PAINT TO MATCH BENJAMIN MOORE OC-31 "FOG MIST" - SATIN FINISH
- V5 3M SCOTCHLITE "BLACK" VINYL FILM NO. 180C-12



19 PARTIAL SIGN ELEVATION/COPY DETAIL
SCALE: 1 1/2" = 1'-0"



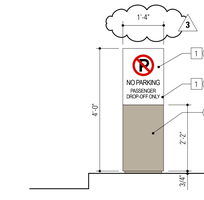
20 SIGN TYPE S7A - ADA DROP-OFF SIGN
SCALE: 1 1/2" = 1'-0"



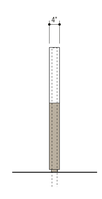
NOTES SDSC_ST13_PassDropoff.ai

1. .125" THICK FABRICATED ALUMINUM CABINET WITH INTERNAL STRUCTURAL FRAMING AND PAINT FINISH. APPLIED VINYL GRAPHICS WITH MATTHEWS CLEAR ACRYLIC POLYURETHANE FINISH COAT. WELD, GRIND AND SAND SMOOTH ALL EXPOSED JOINTS PRIOR TO PAINTING.
2. FLUSH/COUNTERSUNK SCREWS PAINTED TO MATCH SURROUNDING METAL.
3. INTERNAL STRUCTURAL VERTICAL SUPPORT AND/OR STRUCTURAL FRAMING AS REQUIRED BY SIGN CONTRACTORS STRUCTURAL ENGINEERING CALCULATIONS.
4. 3/4" HIGH BASE REVEAL
5. 4" COUNTINUOUS CONCRETE MOW STRIP WITH EASED EDGES. COLOR AND FINISH OF CONCRETE TO MATCH PROJECT STANDARDS.

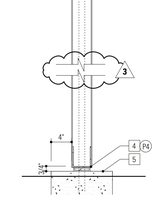
- P3 MATTHEWS PAINT TO MATCH BENJAMIN MOORE BM0C-31 "FOG MIST" - SATIN FINISH
- P4 MATTHEWS PAINT TO MATCH DURANAR UCS763BXL "BRIGHT SILVER" SATIN FINISH
- V1 3M SCOTCHLITE WHITE REFLECTIVE VINYL NO. 680-10
- V2 3M SCOTCHCAL "RED" REFLECTIVE VINYL FILM NO. 680-72
- V3 3M SCOTCHCAL "INTENSE BLUE" VINYL FILM NO. 189C
- V4 3M SCOTCHLITE "BLACK" REFLECTIVE VINYL FILM NO. 680-85



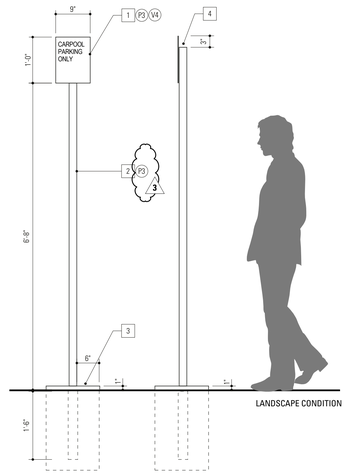
16 ELEVATION - SIGN TYPE S7 - PASSENGER DROP OFF ONLY
SCALE: 1/2" = 1'-0"



17 SIDE ELEVATION
SCALE: 1/2" = 1'-0"

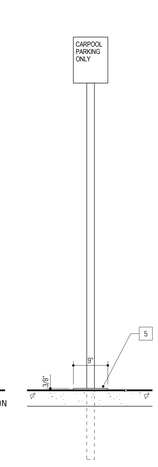


18 SECTION DETAIL - LANDSCAPE CONDITION
SCALE: 1" = 1'-0"

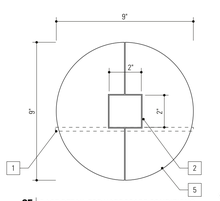


LANDSCAPE CONDITION

21 ELEVATION - SIGN TYPE S8 - CARPOOL PARKING ONLY & S9 - CLEAN AIR VEHICLE PARKING
SCALE: 3/4" = 1'-0"



22 HARDSCAPE CONDITION
SCALE: 3/4" = 1'-0"



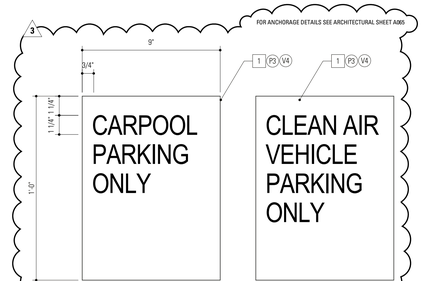
25 BASE DETAIL FOR HARDSCAPE CONDITIONS
SCALE: 3" = 1'-0"

NOTES SAC_ST3B_Carpool CAV_Rg.ai

1. 3/16" THK. ALUMINUM SIGN PANEL WITH PAINT FINISH AND APPLIED VINYL GRAPHICS WITH MATTHEWS SATIN CLEAR OVERCOAT. BACK AND SIDES OF PANEL TO BE PAINTED TO MATCH POST. SIGN PANEL TO BE ADHERED TO POST WITH LORDS ADHESIVE.
2. 2" SHARP CORNER SQUARE ALUMINUM TUBE WITH PAINT FINISH. TUBE WALL THICKNESS TO BE MINIMUM .125" THK. CORNERS TO BE SLIGHTLY EASED TO ENSURE PAINT ADHESION.
3. CONCRETE FOOTING AS REQUIRED BY SIGN CONTRACTORS STRUCTURAL ENGINEERING CALCULATIONS. CONCRETE COLOR AND FINISH TO MATCH PROJECT STANDARDS.
4. CLOSED POST CAP WITH PAINT FINISH TO MATCH POST.
5. 3/8" THK. ALUMINUM X 9" DIAM. ROUND BEAUTY PLATE IN 2 SECTIONS TO FIT AROUND POST. PLATE TO BE EPOXIED TO HARDSCAPE.

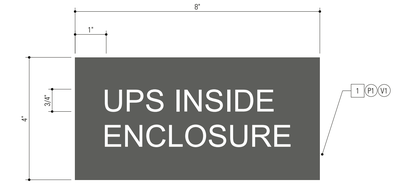
COLORS

- P3 WHITE PAINT FINISH (TBD)
- V4 3M SCOTCHLITE "BLACK" REFLECTIVE VINYL FILM NO. 680-10



23 DETAIL - SIGN TYPE S8
SCALE: 3" = 1'-0"

24 DETAIL - SIGN TYPE S9
SCALE: 3" = 1'-0"



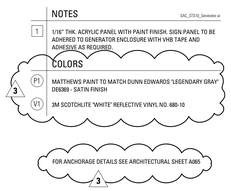
29 ELEVATION - SIGN TYPE S10 - GENERATOR SIGN
SCALE: HALF

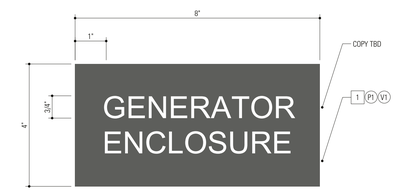
NOTES SAC_ST10_Generator.ai

1. 1/16" THK. ACRYLIC PANEL WITH PAINT FINISH. SIGN PANEL TO BE ADHERED TO GENERATOR ENCLOSURE WITH VHB TAPE AND ADHESIVE AS REQUIRED.

COLORS

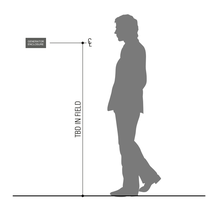
- P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS "LEGENDARY GRAY" DE6369 - SATIN FINISH
- V1 3M SCOTCHLITE "WHITE" REFLECTIVE VINYL NO. 680-10





26 ELEVATION - SIGN TYPE S10 - GENERATOR SIGN
SCALE: HALF

27 SIDE VIEW
SCALE: HALF



28 LOCATION ELEVATION
SCALE: 1/2" = 1'-0"

hGA.
1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

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SAIFUL BOUQUET
155 N LAKE AVE
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SHERMAN OAKS, CA 91423
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949-852-9995

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KPFF CONSULTING ENGINEERS
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213-418-0201

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949-756-0150

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SAN DIEGO, CA 92103
619-297-0159

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RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

STEVEN G. MAH C-29787 SEPTEMBER 30, 2017 RENEWAL 08/31 REGISTERED ARCHITECT

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
2	Addendum 2	9/01/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

GS.12

ADDENDA PACKAGE

SIGNAGE CONSULTANT
DAVIES ASSOCIATES, INC.
9424 DAYTON WAY, #217
BEVERLY HILLS, CA 90210
310-247-9572

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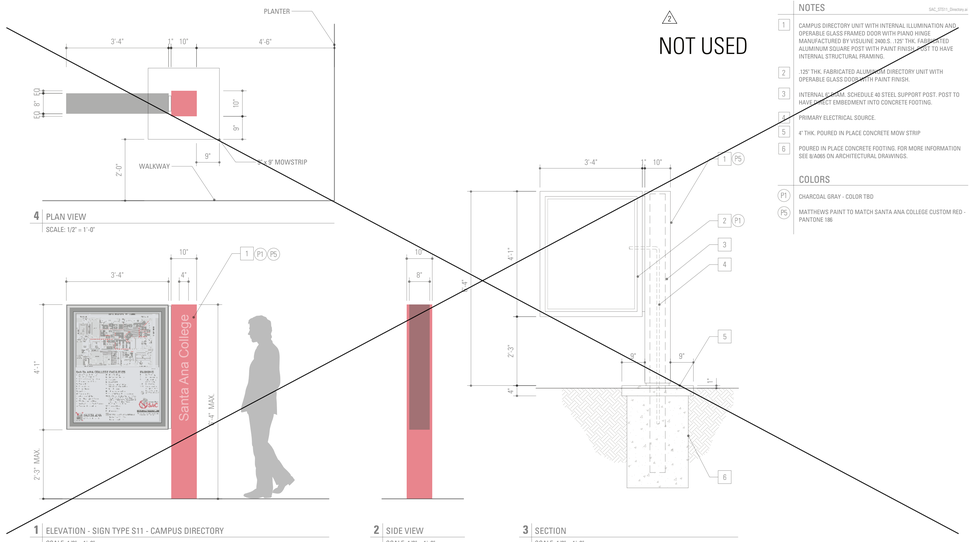


4 | PLAN VIEW
SCALE: 1/2" = 1'-0"

1 | ELEVATION - SIGN TYPE S11 - CAMPUS DIRECTORY
SCALE: 1/2" = 1'-0"

2 | SIDE VIEW
SCALE: 1/2" = 1'-0"

3 | SECTION
SCALE: 1/2" = 1'-0"

NOT USED

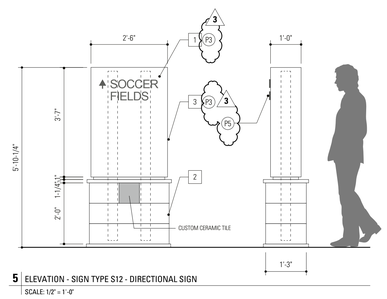
NOTES — SAC_ST511_Directory.ai

1. CAMPUS DIRECTORY UNIT WITH INTERNAL ILLUMINATION AND OPERABLE GLASS FRAMED DOOR WITH PIANO HINGE. MANUFACTURED BY VISUALINE 2400LS. .125" THK. FABRICATED ALUMINUM SQUARE POST WITH PAINT FINISH. POST TO HAVE INTERNAL STRUCTURAL FRAMING.
2. .125" THK. FABRICATED ALUMINUM DIRECTORY UNIT WITH OPERABLE GLASS DOOR WITH PAINT FINISH.
3. INTERNALLY REINF. SCHEDULE 40 STEEL SUPPORT POST. POST TO HAVE DIRECT EMBEDMENT INTO CONCRETE FOOTING.
4. PRIMARY ELECTRICAL SOURCE.
5. 4" THK. POURED IN PLACE CONCRETE MOW STRIP
6. POURED IN PLACE CONCRETE FOOTING. FOR MORE INFORMATION SEE S/A065 ON ARCHITECTURAL DRAWINGS.

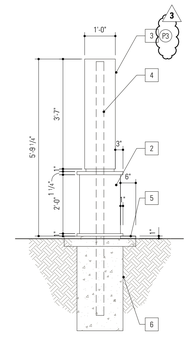
COLORS

P1 CHARCOAL GRAY - COLOR TBD

P5 MATTHEWS PAINT TO MATCH SANTA ANA COLLEGE CUSTOM RED - PANTONE 186



5 | ELEVATION - SIGN TYPE S12 - DIRECTIONAL SIGN
SCALE: 1/2" = 1'-0"



6 | SECTION
SCALE: 1/2" = 1'-0"

NOTES — SAC_ST512_Directional.ai

1. 1/2" THK. ALUMINUM FLAT CUT LETTERS/ARROW MECHANICALLY FASTENED TO CABINET FACE.
2. .125" THK. FABRICATED ALUMINUM BASE WITH CUSTOM TILE CLADDING.
3. .125" THK. FABRICATED ALUMINUM SIGN CABINET WITH PAINT FINISH AND INTERNAL STRUCTURAL FRAMING.
4. 3" DIAM. STEEL SUPPORT POSTS. POST TO HAVE DIRECT EMBEDMENT INTO CONCRETE FOOTING.
5. 4" THK. POURED IN PLACE CONCRETE MOW STRIP
6. POURED IN PLACE CONCRETE FOOTING. FOR MORE INFORMATION SEE S/A065 ON ARCHITECTURAL DRAWINGS.

ALL DIMENSIONS TO BE VERIFIED IN FIELD BASED ON EXISTING DIRECTIONAL SIGN

SAC_Type.ai

ABCDEFGHIJKLMN
OPQRSTUVWXYZ
1234567890

9 | PROJECT TYPEFACE - ARIAL REGULAR
SCALE: NTS

ABCDEFGHIJKLMN
OPQRSTUVWXYZ
1234567890

10 | PROJECT TYPEFACE - ARIAL NARROW REGULAR (SIGN TYPES S1, S2, S3, S3A, S7, S8 & S9 ONLY)
SCALE: NTS

7 | PROJECT SYMBOLS
SCALE: NTS

3

PAINT COLORS

- P1 MATTHEWS PAINT TO MATCH DUNN EDWARDS DE6389 'LEGENDARY GRAY' - SATIN FINISH
- P2 MATTHEWS PAINT TO MATCH DUNN EDWARDS DEW382 'FADED GRAY' - SATIN FINISH
- P3 MATTHEWS PAINT TO MATCH BENJAMIN MOORE BMOC-31 'FOG MIST' - SATIN FINISH
- P4 MATTHEWS PAINT TO MATCH DURANAR 'BRIGHT SILVER' UC57638XL - SATIN FINISH
- P5 MATTHEWS PAINT "JET BLACK" MP30132 - SATIN FINISH

VINYL COLORS

- V1 3M SCOTCHLITE REFLECTIVE "WHITE" NO. 680-10
- V2 3M SCOTCHLITE REFLECTIVE "RED" NO. 680-72
- V3 3M SCOTCHCAL "INTENSE BLUE" NO. 180C-47
- V4 3M SCOTCHLITE REFLECTIVE "BLACK" NO. 680-85
- V5 3M SCOTCHCAL "BLACK" NO. 180C-12
- V6 3M SCOTCHCAL "PEARL GRAY" NO. 7725
- V7 ARLON SERIES 2100 "MEDIUM GRAY" NO. 50

ROWMARK

- R1 "LIGHT GRAY" 3XI-305

8 | COLOR SCHEDULE
SCALE: NTS

hGA.
1918 Main Street, Third Floor
Santa Monica , California 90405
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1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA.

LICENSED ARCHITECT — NOEL A. DAVIES — No. C-20000 — EXPIRATION DATE: SEPTEMBER 30, 2017 — STATE OF CALIFORNIA

NAME: NOEL DAVIES
DATE: JULY 06, 2017
REGISTRATION NUMBER: N/A

NO	DESCRIPTION	DATE
2	Addendum 2	9/01/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: BD / LN | REVIEW BY: ND

HGA NO: 3584-001-00

SIGNAGE DETAILS

DATE: JULY 06, 2017

GS.13

ADDENDA PACKAGE

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DAVIES ASSOCIATES, INC.
9424 DAYTON WAY, #217
BEVERLY HILLS, CA 90210
310-247-9572

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GENERAL NOTES

1. ALL WALL BENCHTOPS AND MOVABLE TABLES SHALL BE 30" DEEP INCLUDING WALL BENCH BACK SPLASH (UNLESS OTHERWISE NOTED).
2. ALL ISLAND/PENINSULA BENCHTOPS SHALL BE 60" DEEP (UNLESS OTHERWISE NOTED).
3. ALL BENCHES AND TABLES SHALL BE 36" HIGH (UNLESS OTHERWISE NOTED).
4. ALL BENCH/TABLE TOPS TO BE 1" THICK EPOXY RESIN (UNLESS OTHERWISE NOTED).
5. ALL BACK AND SIDE SPLASHES TO BE 3/4" THICK AND 4" HIGH, PIPEDROP CURBS TO BE 3/4" THICK AND 5" HIGH (UNLESS OTHERWISE NOTED).
6. PROVIDE SIDESPLASHES AT ALL BENCH TOPS AGAINST FUME HOODS AND/OR ADJACENT WALLS.
7. OVERALL LENGTH OF BENCHTOPS SHALL BE DETERMINED BY CASEWORK SIZES AND DIMENSIONS AS INDICATED ON PLANS. TOPS SHALL OVERHANG 1/2" AT EACH END AND 1" FROM FRONT OF BASE CABINETS AND TABLES. WHEN OVERALL DIMENSIONS ARE GIVEN, 1/2" OVERHANG IS NOT INCLUDED.
8. ALL CASEWORK, FUME HOODS AND ANY OTHER FURNISHINGS WITH EXPOSED-TO-VIEW BACKS AND SIDES SHALL BE FINISHED.
9. INSTALL CLOSURE PANELS BETWEEN BACK OF HOODS AND WALLS AT EXPOSED ENDS AND BETWEEN BASE CABINETS AND/OR HOODS THAT ARE SET BACK TO BACK. FOR BASE CABINETS, PROVIDE EXTENDED ENDS AT THESE LOCATIONS.
10. ALL PENETRATIONS THROUGH BENCHTOP SHALL BE SEALED WITH SEALANT.
11. BACKS OF COUNTERTOPS AND SPLASHES AGAINST WALLS SHALL BE SEALED TO THE WALL WITH SEALANT.
12. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS PRIOR TO FABRICATION.
13. OWNER'S REPRESENTATIVE WILL SELECT COLORS FOR ALL COMPONENTS OF PROJECT INDICATED ON THESE DRAWINGS. COLOR SELECTION WILL BE FROM THE CASEWORK MANUFACTURER'S STANDARD COLOR LINE.
14. FREE STANDING SHELVING AND CASEWORK LESS THAN 18" DEEP SHALL BE SECURED TO PREVENT TIPPING. SUBMIT SHOP DRAWINGS OF ATTACHMENT PRIOR TO INSTALLATION.
15. SAFETY SHOWER/EYEWASH UNITS SHALL COMPLY WITH ANSI STANDARDS FOR USABILITY BY THE PHYSICALLY DISABLED. SAFETY SHOWER/EYEWASH UNITS SHALL BE FURNISHED UNDER DIVISION 11 FOR INSTALLATION UNDER DIVISION 22.
16. FOR LABORATORY SERVICE FITTING TYPES, LOCATIONS AND ORDER, SEE LABORATORY FURNISHINGS PLANS. THESE FITTINGS SHALL BE PROVIDED UNDER DIVISION 11, FOR INSTALLATION UNDER DIVISION 22 U.O.N.
17. AT ALL TALL FREESTANDING VENTED, CORROSIVE, OR SOLVENT STORAGE CABINETS, VENT PIPING WILL BE PROVIDED AND INSTALLED FROM THE CABINET POINT OF CONNECTION TO THE EXHAUST DUCT SYSTEM PER DIVISION 23.
18. WHERE NO FUME HOOD OCCURS ADJACENT TO UNDER COUNTER CORROSIVE STORAGE CABINETS, ROUTE VENT PIPE (IN PIPE CHASE) UP NEAREST PIPE DROP ENCLOSURE TO EXHAUST DUCT SYSTEM FOR CONNECTION UNDER DIVISION 23.
19. WHERE FUME HOOD OCCURS ADJACENT TO UNDER COUNTER CORROSIVE STORAGE CABINETS, ROUTE VENT PIPE (IN PIPE CHASE) TO FUME HOOD AND EXTEND 4" ABOVE FUME HOOD WORK SURFACE BEHIND BAFFLE.
20. SNORKEL EXHAUST EQUIPMENT SHOWN ON THESE DRAWINGS SHALL BE PROVIDED UNDER DIVISION 11. DIVISION 23 SHALL PROVIDE DUCTWORK ROUTING AND MAKE FINAL CONNECTION TO SNORKEL EQUIPMENT.
21. LOCATION OF EQUIPMENT, SUCH AS FUME HOODS, OVERHEAD SERVICE CARRIERS, BRACES OR ANY OTHER ITEMS THAT MAY INTERFERE WITH LIGHTING, STRUCTURAL OR MECHANICAL SYSTEMS, SHALL BE CAREFULLY COORDINATED. NOTIFY OWNER'S REPRESENTATIVE OF DISCREPANCIES PRIOR TO PROCEEDING WITH WORK.
22. UNLESS OTHERWISE NOTED, ALL MISCELLANEOUS CHANNELS, BRACKETS AND FITTINGS INDICATED ON ALL LABORATORY FURNISHINGS DRAWINGS SHALL BE SUPPLIED, INSTALLED AND PAINTED UNDER DIVISION 11.
23. CONTRACTOR SHALL EXAMINE ALL LABORATORY FURNISHINGS PLANS AND COORDINATE WITH REFLECTED CEILING PLANS FOR PROPER CEILING HEIGHTS & PIPE DROP ENCLOSURE HEIGHTS AND LOCATIONS.
24. OVERHEAD SERVICE CARRIERS, HEAVY DUTY UNISTRUT AND OTHER STRUCTURALLY ANCHORED AND SUSPENDED DEVICES WHICH REQUIRE COORDINATION WITH OTHER TRADES SHALL BE THE RESPONSIBILITY OF THIS DIVISION (UNLESS OTHERWISE NOTED). ADDITIONAL FRAMING MAY BE REQUIRED TO ACCOMMODATE ANCHORAGE AROUND DUCTWORK OR OTHER OBSTRUCTIONS.
25. ALL BULLETIN BOARDS, MARKER BOARDS, CHALKBOARDS, PROJECTION SCREENS, COAT RACKS AND FIRE EXTINGUISHERS ARE INDICATED ON THE "LF" DRAWINGS FOR COORDINATION ONLY.
26. SERVICE FITTINGS SHOWN ON THE "LF" PLAN DRAWINGS ARE FOR LOCATION ONLY. REFER TO DETAILS AND SPECIFICATIONS FOR ACTUAL FITTINGS.
27. ELECTRICAL DEVICES SHALL BE PROVIDED UNDER DIVISION 26. ELECTRICAL DEVICES SHOWN ON THE "LF" DRAWINGS ARE FOR THE LOCATION OF CASEWORK CUTOUTS. DEVICES SHOWN AT CONTROLLED ENVIRONMENTAL ROOMS, FUME HOODS AND LAMINAR FLOW HOODS SHALL BE PROVIDED BY THE EQUIPMENT SUPPLIER.
28. ALL WALL MOUNTED RACEWAYS SHALL BE MOUNTED 41" A.F.F. TO THE BOTTOM OF THE RACEWAY U.O.N.
29. PAPER TOWEL AND SOAP DISPENSERS SHOWN FOR COORDINATION PURPOSES. REFER TO ARCHITECTURAL FOR ALL FINAL LOCATIONS, DETAILS, AND OTHER REQUIREMENTS.

2

LABORATORY SYMBOLS LEGEND

	SYMBOL LEGEND	DESCRIPTION	DETAIL
1		PIPE DROP ENCLOSURE (1/LF4.02, 2/LF4.02)	3/LF4.02
2		DRYING RACK	8/LF4.01
3		ADJUSTABLE WALL SHELVES (2 TIER U.O.N.)	9/LF4.03
4		ADJUSTABLE ISLAND BENCH SHELVING (2 TIER U.O.N.) (7/LF4.03)	8/LF4.03
5		HEAVY DUTY ADJUSTABLE SHELVES (5 TIER U.O.N.)	1/LF4.04
6		WIRE SHELVING UNIT	4/LF4.04
7		CYLINDER RESTRAINT	5/LF4.02
8		CYLINDER RACK ASSEMBLY	6/LF4.02
9		SNORKEL FUME EXHAUST - SEE EXHAUST SCHEDULE	9/LF4.00
10		OVERHEAD SERVICE CARRIER	1/LF4.03
11		OVERHEAD UNISTRUT	4/LF4.03
12	SS EW	SAFETY SHOWER WITH EYEWASH UNIT	2/LF5.02
13	SS	RECESSED SAFETY SHOWER WITH EYEWASH UNIT	1/LF5.02
14		GARBAGE DISPOSAL (BY DIV. 22, SHOWN FOR COORDINATION ONLY)	
15		COAT HOOKS - (SEE ARCHITECTURAL DRAWINGS - SHOWN FOR COORDINATION ONLY)	
16		WATER PURIFIER - OWNER FURNISHED, OWNER INSTALLED	
17		PROJECTION SCREEN (SEE ARCHITECTURAL DOCUMENTS, SHOWN FOR COORDINATION ONLY)	
18		WHITE PROJECTION MARKER BOARD (SEE ARCHITECTURAL DOCUMENTS, SHOWN FOR COORDINATION ONLY)	
19		TACK BOARD (SEE ARCHITECTURAL DOCUMENTS, SHOWN FOR COORDINATION ONLY)	
20		CANOPY HOOD - SEE EXHAUST SCHEDULE	8/LF4.00
21		EXAM LIGHT WITH STEM HANDLE - REFER TO SPECIFICATION SECTION 115350	
22		FIXED REAGENT SHELVES - (1 TIER U.O.N.)	2/LF4.04
23		LASER EXHAUST - SEE EXHAUST SCHEDULE	
24	OFCI	OWNER FURNISHED AND INSTALLED BY THE GENERAL CONTRACTOR INCLUDING SEISMIC BRACING. REFER TO ARCHITECTURAL FOR ALL INSTALLATION INFORMATION.	
	WCxx	WALL CABINET - SEE CASEWORK MENU	
	TAxx	TALL STORAGE CABINET - SEE CASEWORK MENU	
	MT	MOVABLE TABLE - SEE CASEWORK MENU	
		LEG POST UNDER BENCH/TABLE TOP	
	6'CFH	CHEMICAL FUME HOOD - SEE EXHAUST SCHEDULE (1/LF4.00)	2/LF4.00
		OWNER FURNISHED, OWNER INSTALLED EQUIPMENT	
		EPOXY RESIN SINK - SEE SINK SCHEDULE	
		STAINLESS STEEL SINK - SEE SINK SCHEDULE	
		CUP SINK - SEE SINK SCHEDULE	
		STAINLESS STEEL SCULLERY SINK - SEE SINK SCHEDULE	
		ADA COMPLIANT AREA	
	FD	FLOOR DRAIN (SHOWN FOR COORDINATION ONLY)	
	FS	FLOOR SINK (SHOWN FOR COORDINATION ONLY)	
		30"X36" CLEAR ADA/CBC AREA	

3

LABORATORY BENCHTOP SCHEDULE

E EPOXY RESIN BENCHTOP

S STAINLESS STEEL BENCHTOP

+30", +34", +36" INDICATES BENCHTOP HEIGHT ABOVE FINISHED FLOOR

NOTE:

FOR BENCHTOP TRANSITION HEIGHT REFER TO DETAILS: 7/LF4.01

DETAIL SYMBOLS LEGEND

DETAIL NUMBER / SHEET NUMBER

SECTION NUMBER / SHEET NUMBER

ELEVATION NUMBER / SHEET NUMBER

ELECTRICAL SYMBOLS (SHOWN FOR LOCATION OF CASEWORK AND BENCH TOP CUT-OUTS)

120V, 1PH, 20A SINGLE RECEPTACLE

120V, 1PH, 20A DUPLEX RECEPTACLE

DOUBLE DUPLEX RECEPTACLE

PEDESTAL BOX

SURFACE RACEWAY

TYPICAL ABBREVIATIONS

(NOTE: NOT ALL ABBREVIATIONS SHOWN ARE USED. REFER TO FLOOR PLANS FOR ACTUAL ABBREVIATION TYPES.)

ADA/CBC	AMERICAN DISABILITIES ACT/ CALIFORNIA BUILDING CODE
A.F.F.	ABOVE FINISHED FLOOR
ARCH	ARCHITECTURAL DOCUMENTS
CFM	CUBIC FEET/MINUTE
CENT	CENTRIFUGE
CLG.	CEILING
CLR.	CLEARANCE
DIA	DIAMETER
DIV.	DIVISION
EQUIP	EQUIPMENT
FZR	FREEZER
GA.	GAUGE
G.C.	GENERAL CONTRACTOR
G.W.	GLASSWARE WASHER
H.D.	HEAVY DUTY
INC	INCUBATOR
MAX.	MAXIMUM
MIN.	MINIMUM
MTD.	MOUNTED
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
OFOI	OWNER FURNISHED, OWNER INSTALLED
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
O.H.	OVERHEAD
OHSC	OVERHEAD SERVICE CARRIER
PH	PHASE
P.T.D.	PAPER TOWEL DISPENSER
S.D.	SOAP DISPENSER
REF	REFRIGERATOR
SIM.	SIMILAR
SPEC	SPECIFICATIONS
ST.STL.	STAINLESS STEEL
TEMP	TEMPERATURE
TYP.	TYPICAL
UC	UNDER COUNTER
U.O.N.	UNLESS OTHERWISE NOTED
WP	WEATHERPROOF

LABORATORY SERVICE ABBREVIATIONS

CA	COMPRESSED LAB AIR (100 PSIG)
CO2	CARBON DIOXIDE
EW	EYEWASH
ICW	INDUSTRIAL COLD WATER
IHW	INDUSTRIAL HOT WATER
LG	LABORATORY GAS
LV	LABORATORY VACUUM
PW	PURIFIED WATER
SS	SAFETY SHOWER
(HB)	HOSE BIBB
(IR)	INFRA-RED
(FT)	FOOT OPERATED
__(VB)	VALVE BOX - PROVIDED UNDER DIV. 22
__(V)	SERVICE VALVE - PROVIDED UNDER DIV. 22

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LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

LICENSED ARCHITECT SEAN TOWNE No. C14749 REN. 9-30-2017 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

GENERAL NOTES

DATE: JULY 06, 2017

LF1.00

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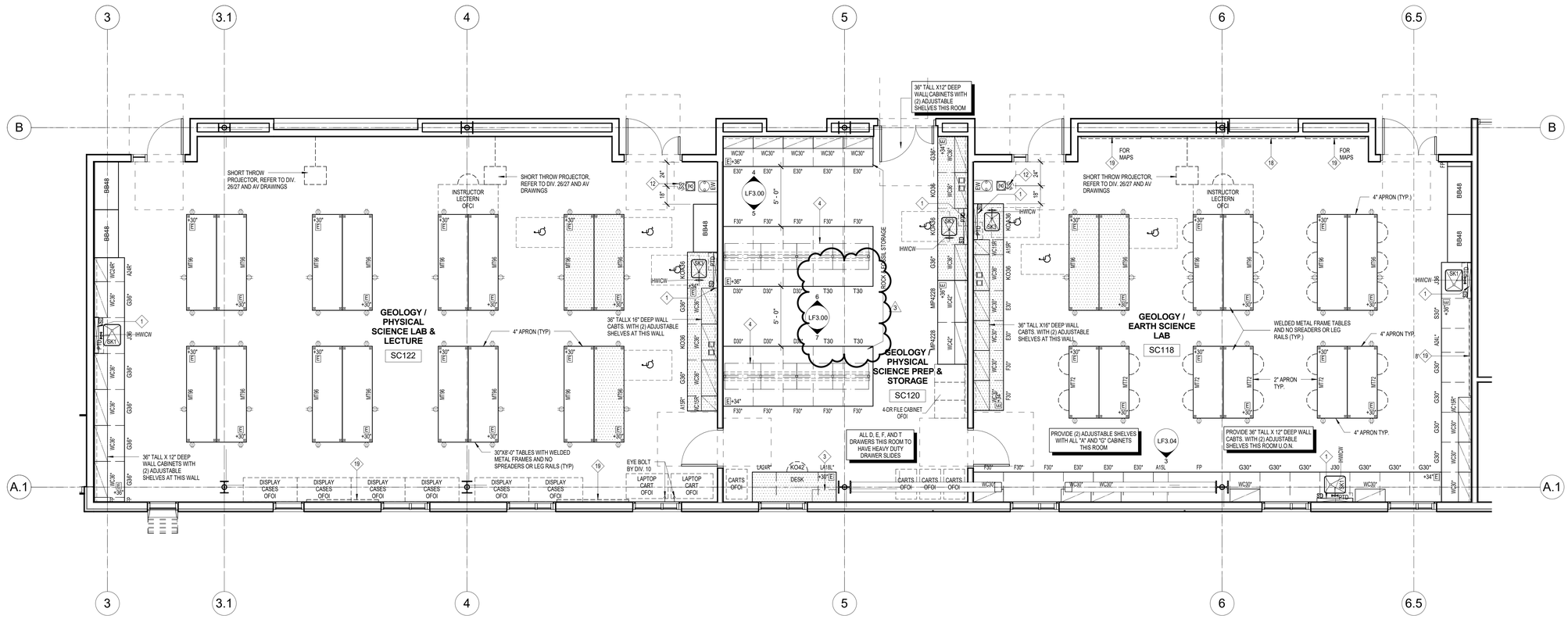

1 FIRST LEVEL PARTIAL PLAN
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LICENSED ARCHITECT KEN YORIMITSU No. 27476 RENEWAL 9-30-2017 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	09/22/17

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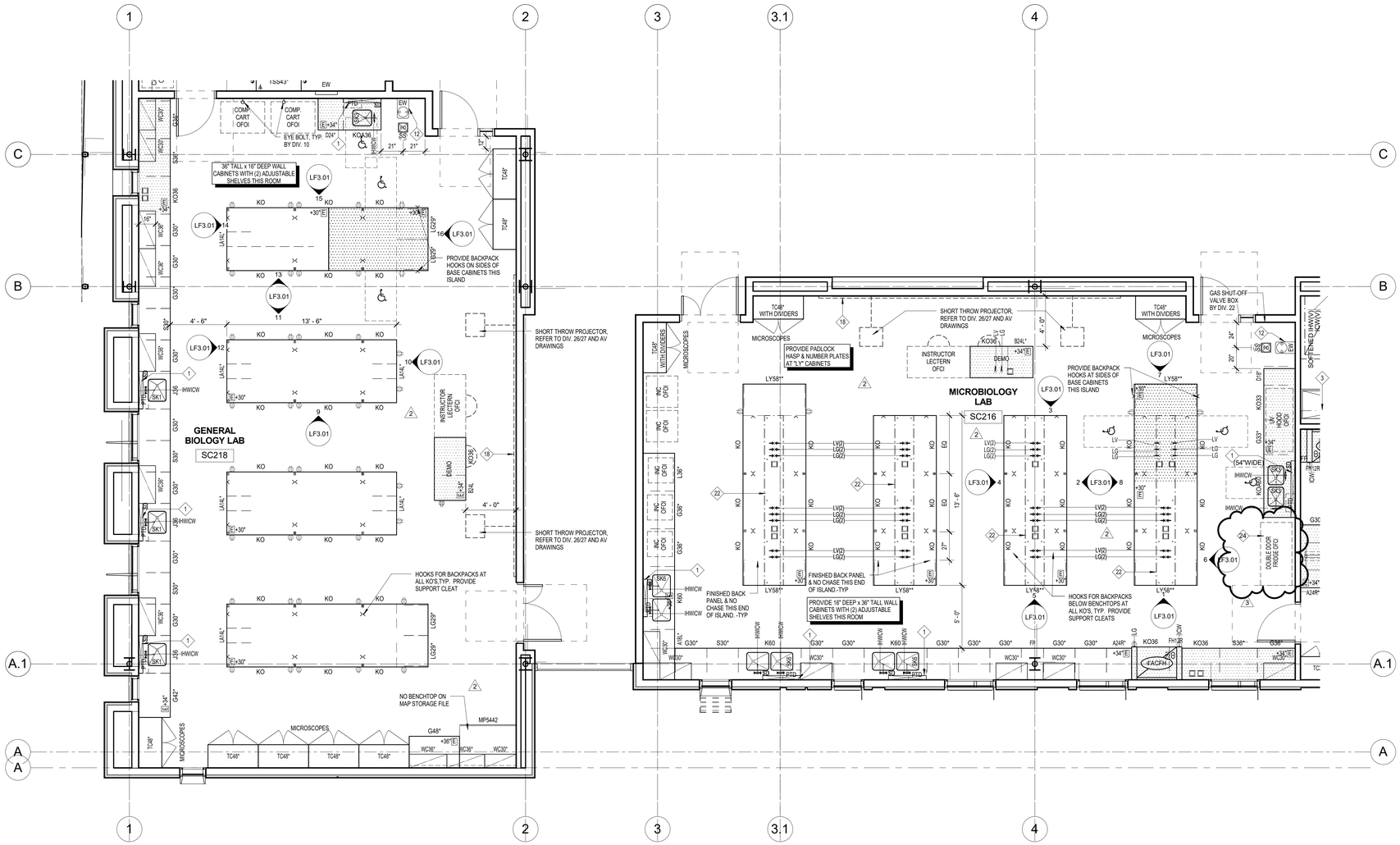

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

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SECOND LEVEL PARTIAL PLAN

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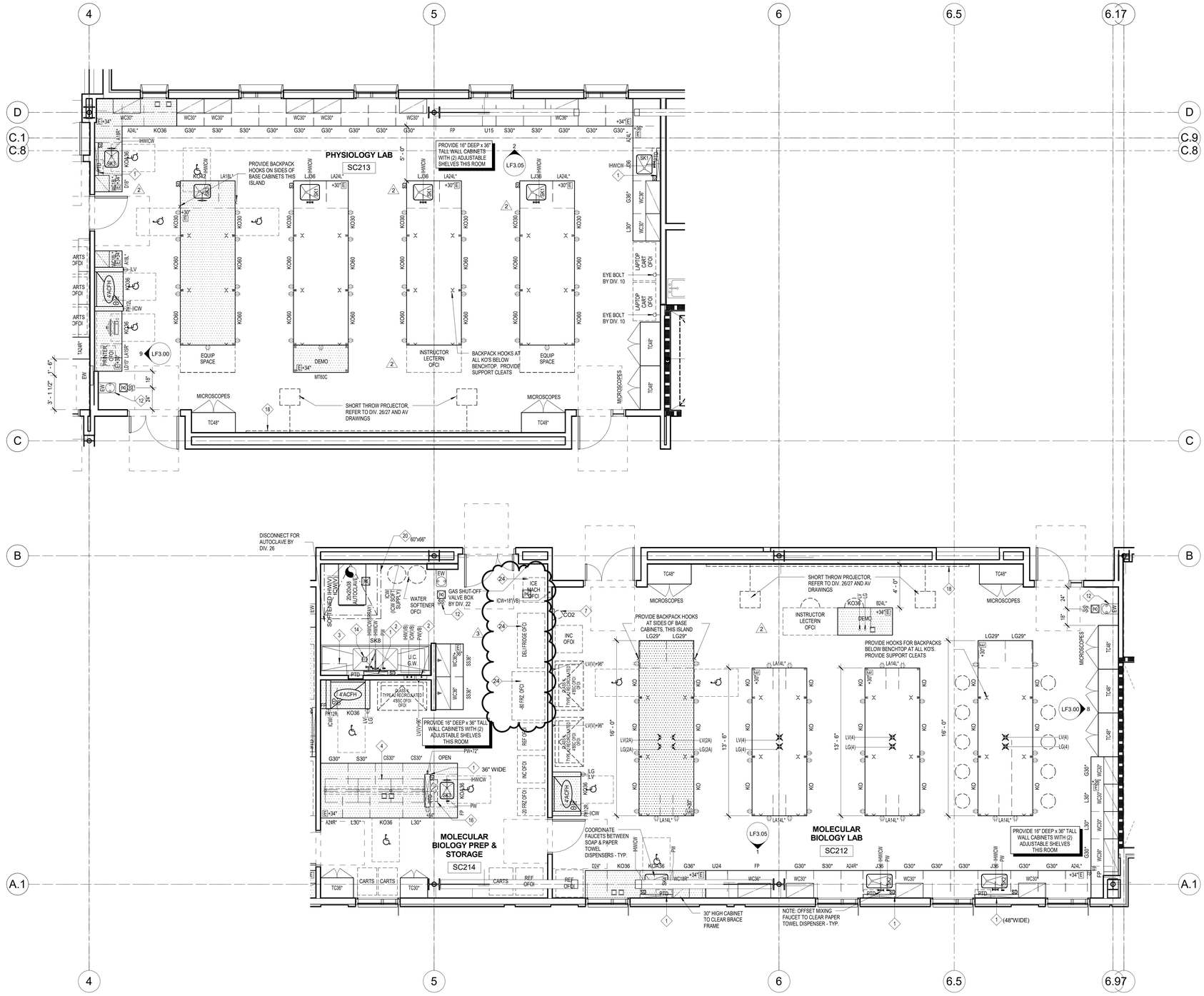

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LICENSED ARCHITECT JAMES G. MATSON NO. C13036 REGISTERED IN 2017 MEMBER OF THE AIA STATE OF CALIFORNIA

LICENSED ARCHITECT SEAN TOBIN NO. C-13749 REN 9-30-2017 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

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SECOND LEVEL PARTIAL PLAN

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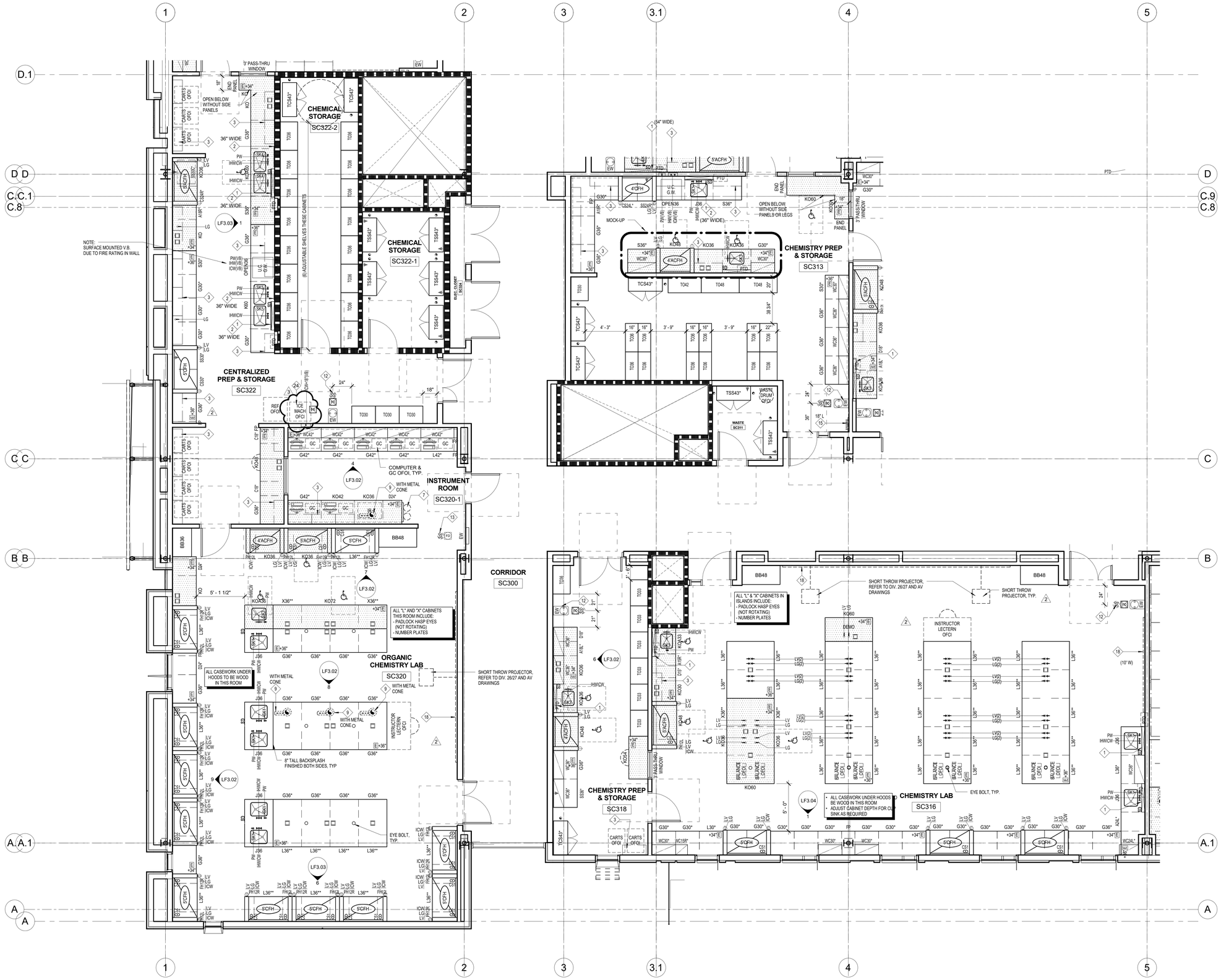

1 THIRD LEVEL PARTIAL PLAN
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LICENSED ARCHITECT SAN YOSHIO No. C13036 REN. 9/30/2017 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	Addendum 2	09/01/17
3	Addendum 3	09/22/17

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THIRD LEVEL PARTIAL PLAN

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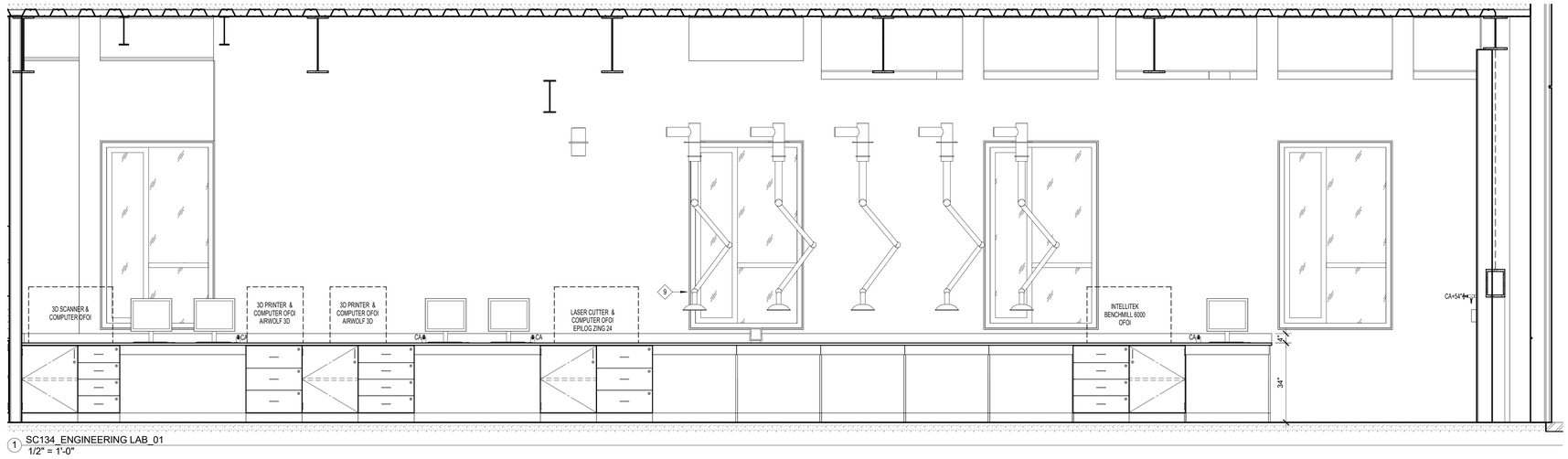

1 SC134_ENGINEERING LAB_01
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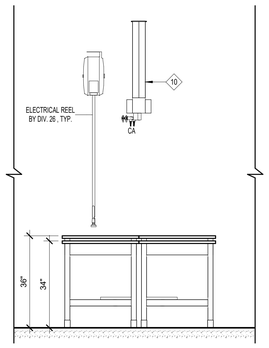

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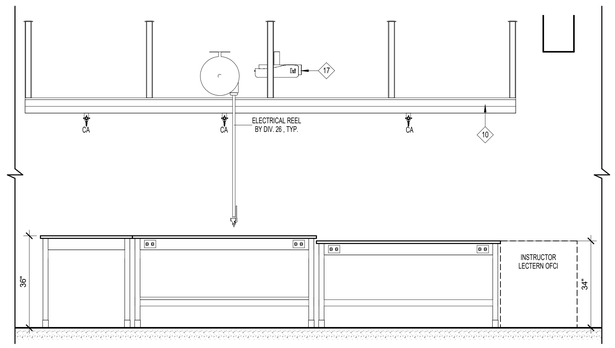

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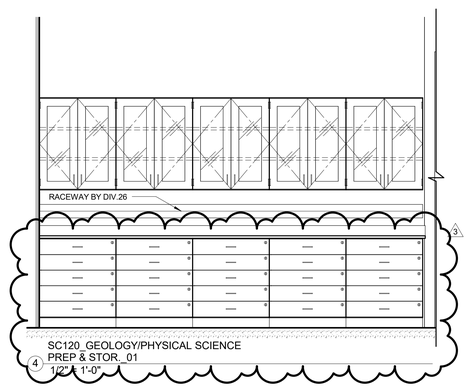

4 SC120_GEOLOGY/PHYSICAL SCIENCE PREP & STOR_ 01
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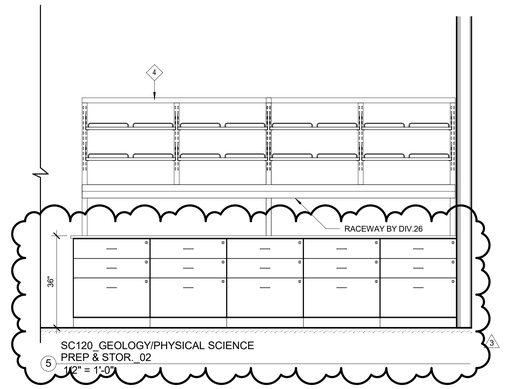

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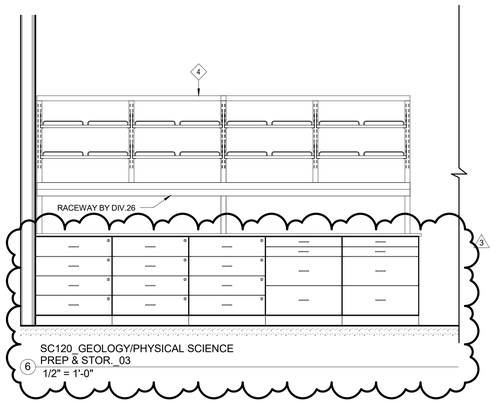

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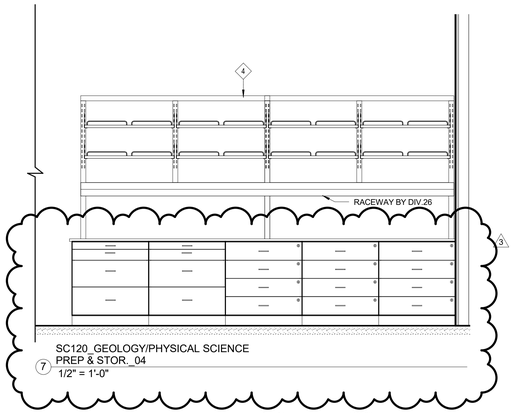

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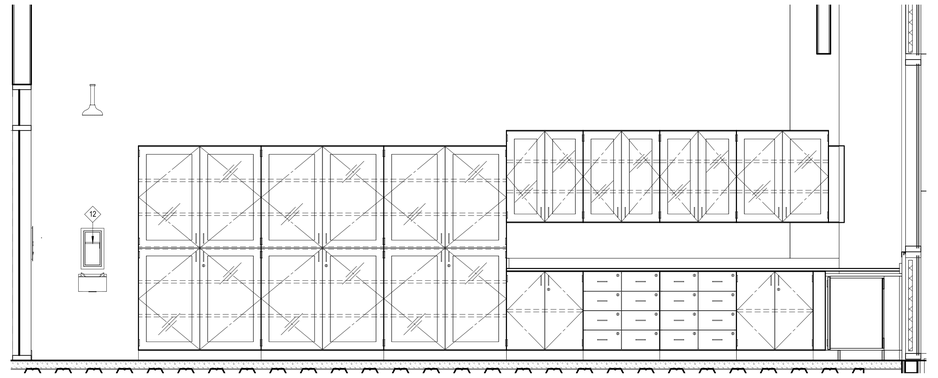

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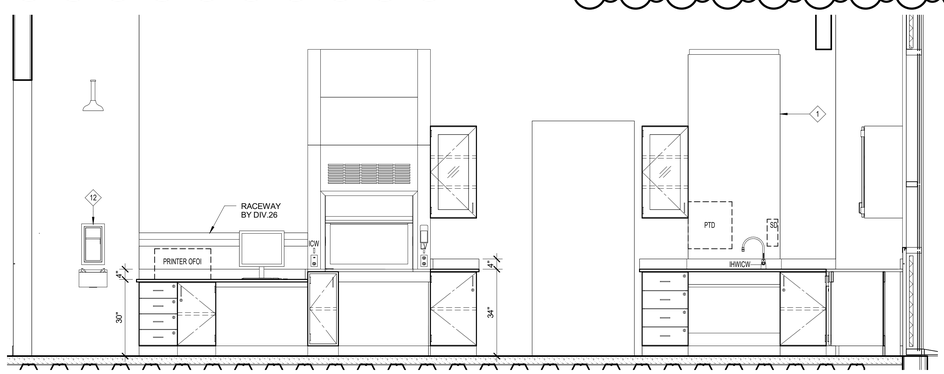

9 SC213_PHYSIOLOGY LAB_01
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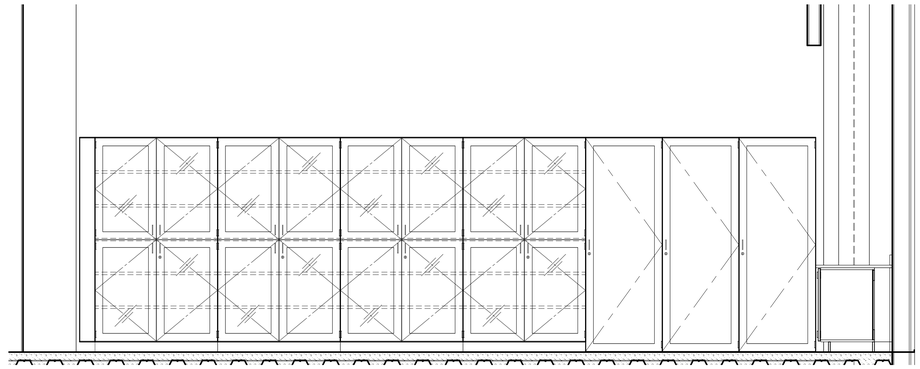

10 SC217_ANATOMY LAB_01
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LICENSED ARCHITECT JAMES G. MATSON No. 13036 RENEWAL DATE SEPTEMBER 30, 2017 STATE OF CALIFORNIA

LICENSED ARCHITECT BENJAMIN TOMLINSON No. 27443 RENEWAL DATE SEPTEMBER 30, 2017 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

ELEVATIONS

DATE: JULY 06, 2017

LF3.00

ADDENDA PACKAGE

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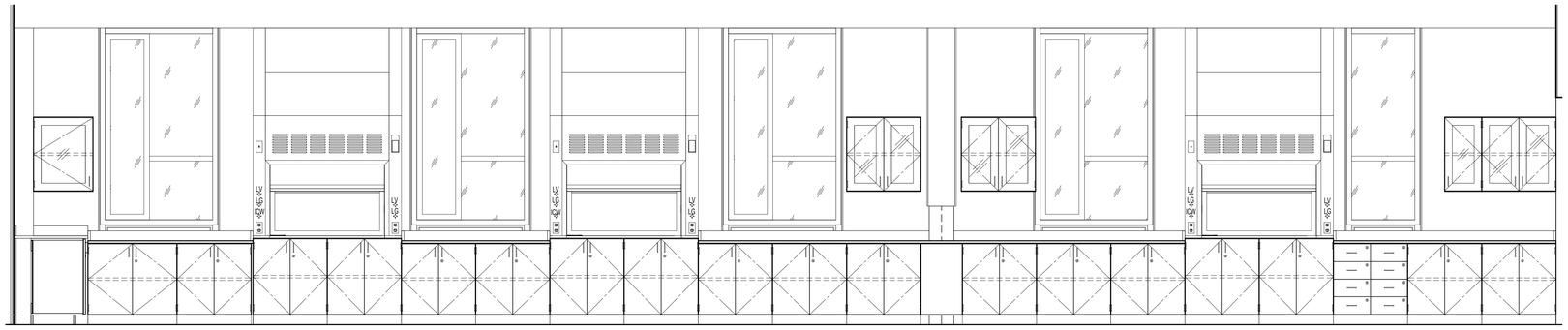
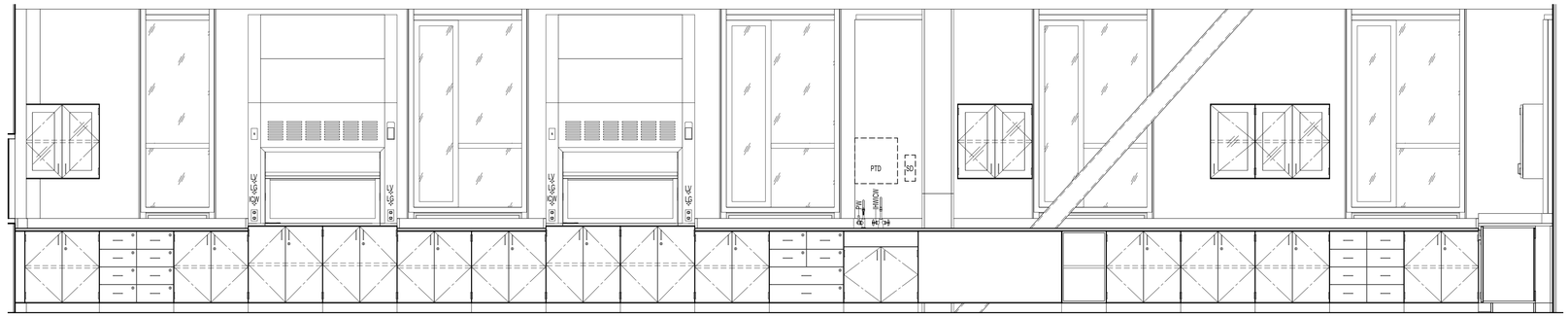


1 SC316 CHEMISTRY LAB
1/2" = 1'-0"



2 SC309 CHEMISTRY LAB
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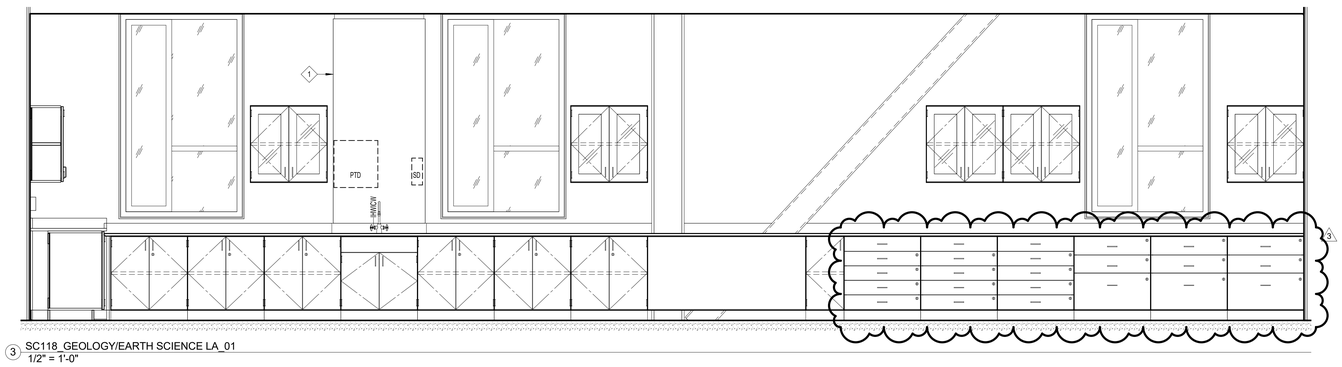

3 SC118_GEOLOGY/EARTH SCIENCE LA_01
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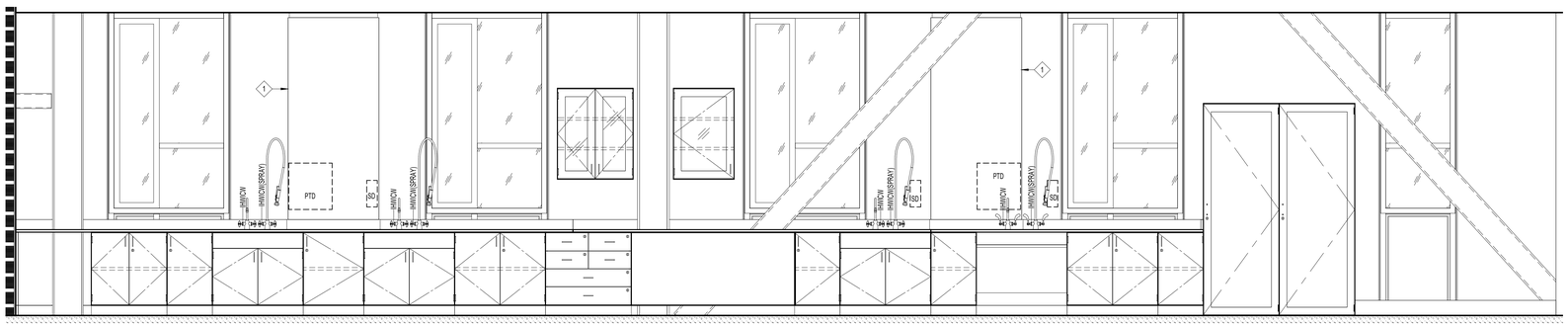

4 SC217_ANATOMY LAB_02
1/2" = 1'-0"

hga.
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LICENSED ARCHITECT JAMES G. MATSON No. C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

LICENSED ARCHITECT JOHN TRIMBLE No. C 27743 REN. 8-30-2017 STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	Addendum 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

ELEVATIONS

DATE: JULY 06, 2017

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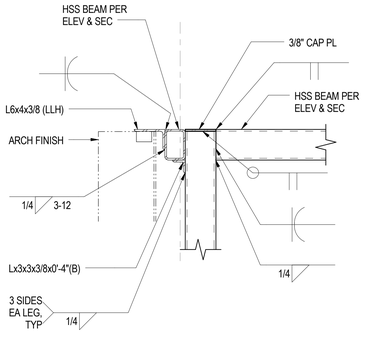
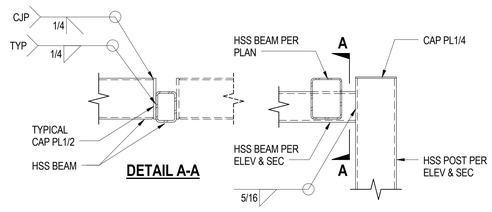


11 STEEL CONNECTION DETAIL
1" = 1'-0"



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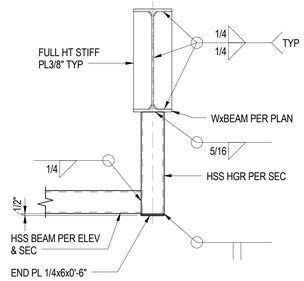
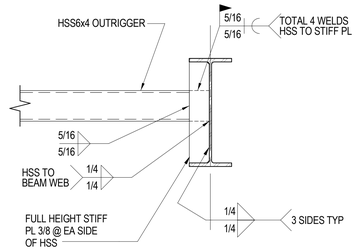


9 STEEL CONNECTION DETAIL
3/4" = 1'-0"



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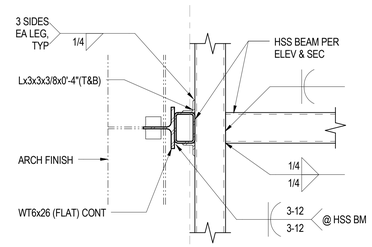
1" = 1'-0"



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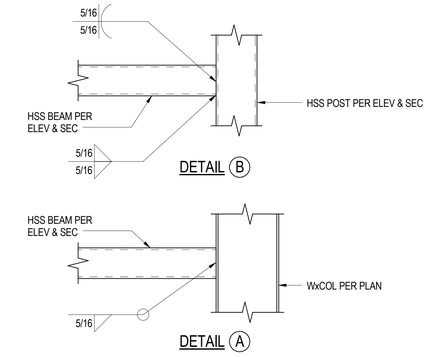
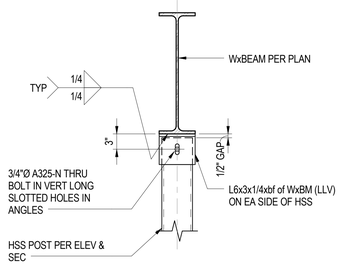


6 STEEL CONNECTION DETAILS
1" = 1'-0"



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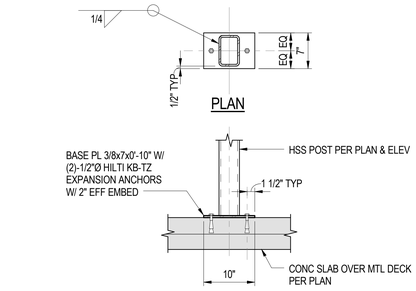
1" = 1'-0"



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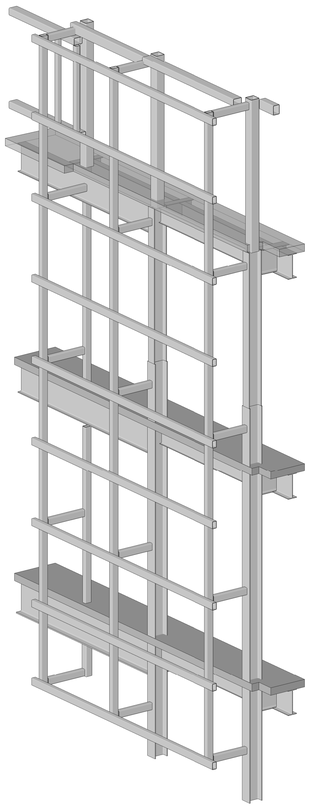
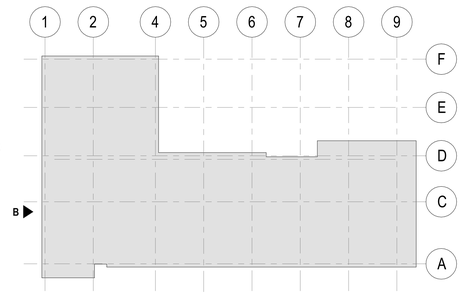
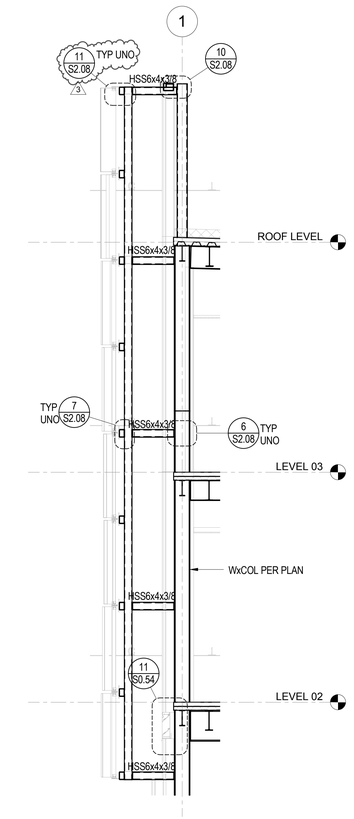


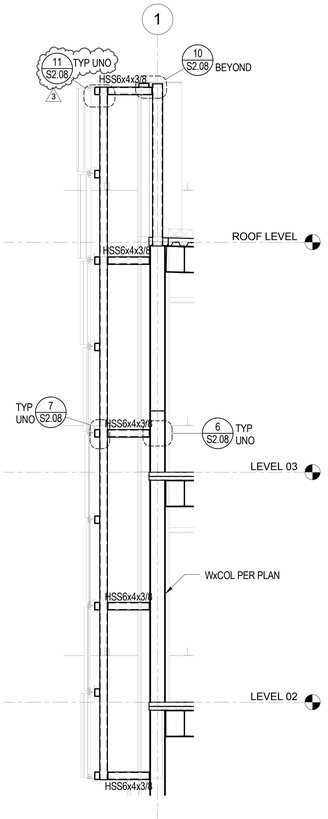
A 3D - WEST MURAL FRAMINMG



KEY PLAN



3 WEST MURAL SECTION
1/4" = 1'-0"



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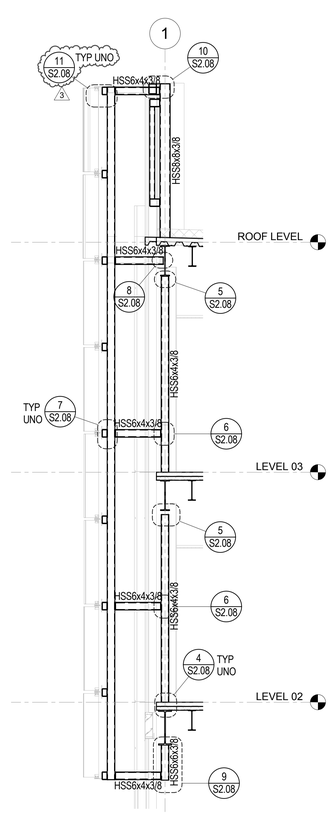
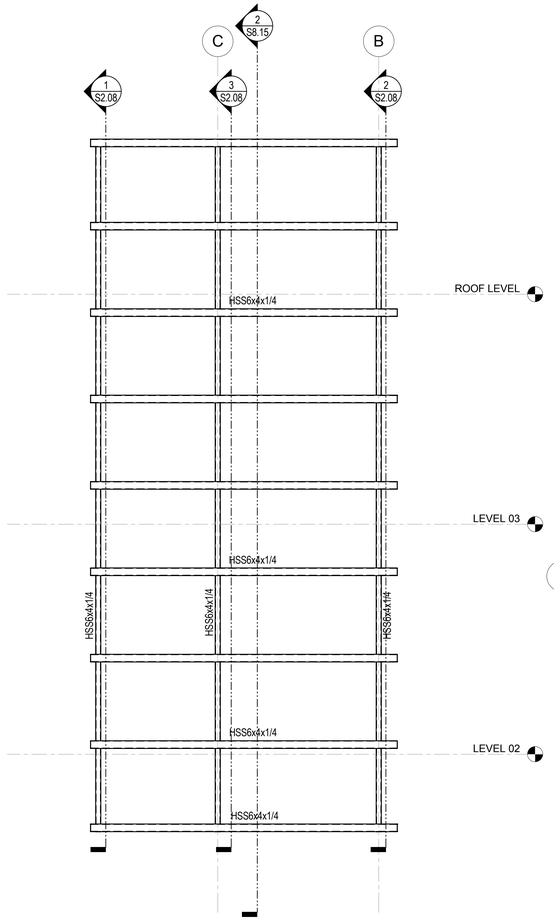
1/4" = 1'-0"



1 WEST MURAL SECTION
1/4" = 1'-0"



B WEST MURAL ELEVATION
1/4" = 1'-0"

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LICENSED ARCHITECT — STATE OF CALIFORNIA — SEPTEMBER 30, 2017 — RENEWAL DATE

REGISTERED PROFESSIONAL ENGINEER — No. 54093 — Exp. 12/31/18 — STRUCTURAL — STATE OF CALIFORNIA

NAME: YENG KEONG LOW
DATE: DECEMBER 31 2018
REGISTRATION NUMBER: 54093

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

WEST MURAL FRAMING AND DETAILS

DATE: JULY 06, 2017

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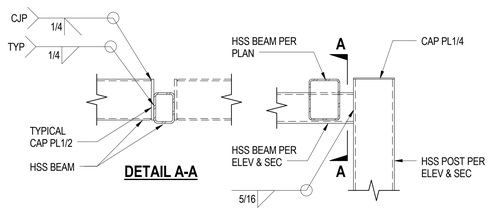
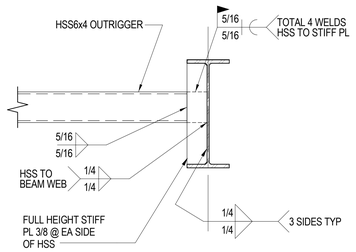
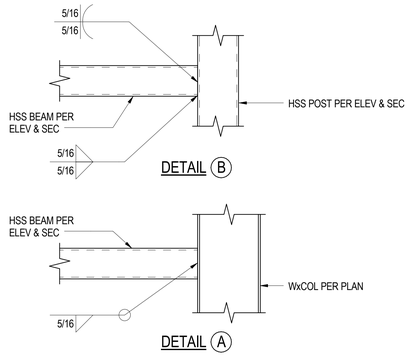


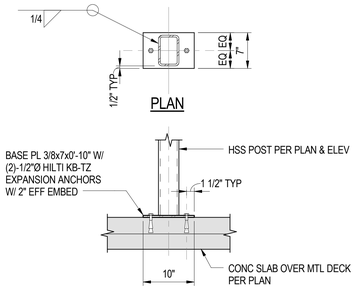
10 STEEL CONNECTION DETAIL
1" = 1'-0"



8 STEEL CONNECTION DETAIL
1" = 1'-0"



6 STEEL CONNECTION DETAILS
1" = 1'-0"



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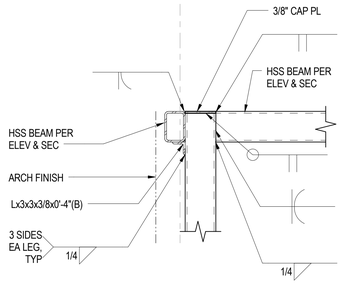
1" = 1'-0"



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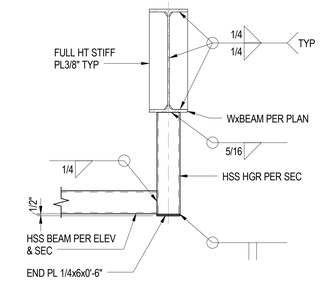

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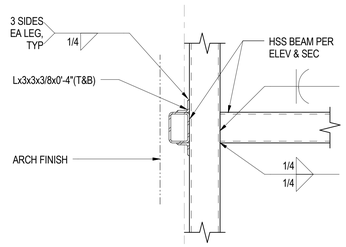
3/4" = 1'-0"



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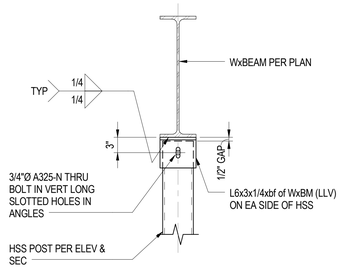

5 STEEL CONNECTION DETAIL
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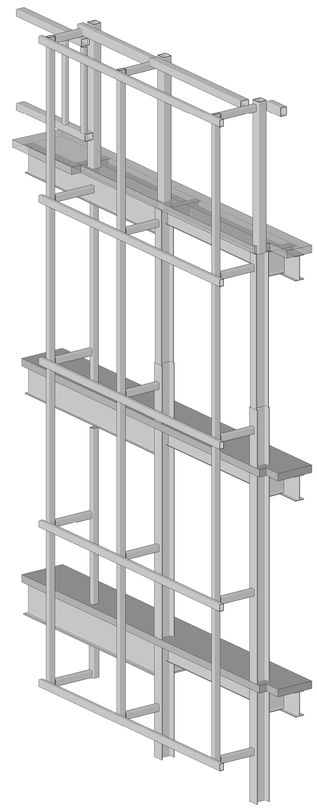
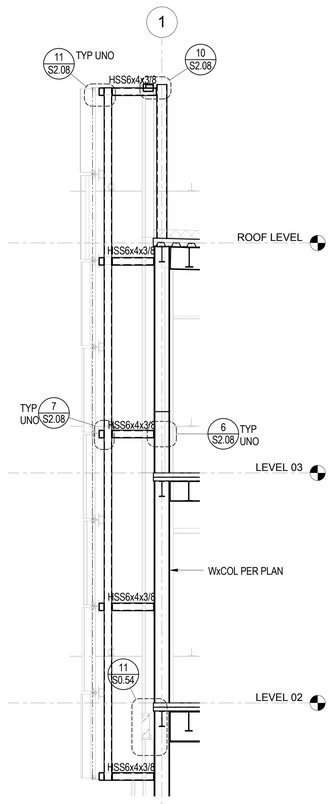
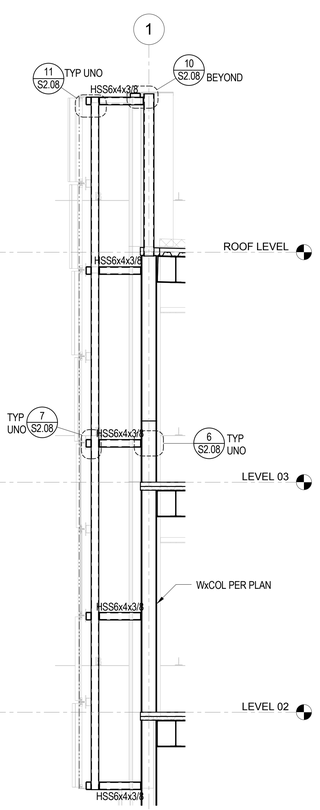




3 WEST MURAL SECTION
1/4" = 1'-0"



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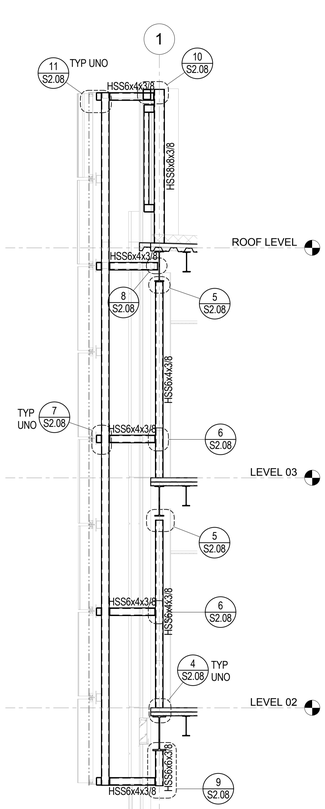

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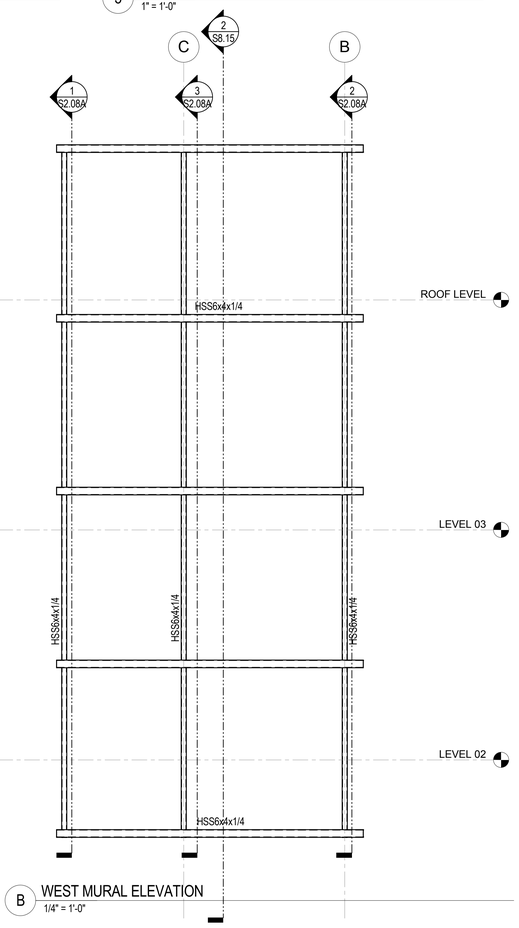
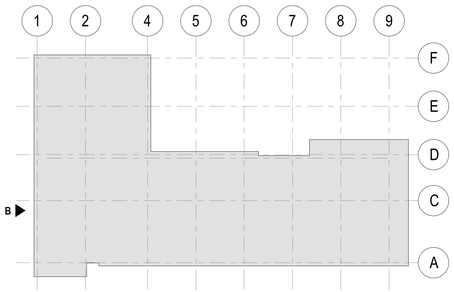
1/4" = 1'-0"



B WEST MURAL ELEVATION
1/4" = 1'-0"



KEY PLAN

HGA
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

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LICENSED ARCHITECT — NAME: YENG KEONG LOW — No. S4093 — Exp. 12/31/18 — REGISTERED PROFESSIONAL ENGINEER — STRUCTURAL — STATE OF CALIFORNIA

NAME: YENG KEONG LOW
DATE: DECEMBER 31 2018
REGISTRATION NUMBER: S4093

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: Author — REVIEW BY: Approver

HGA NO: 3584-001-00

ALTERNATE WEST MURAL FRAMING AND DETAILS

DATE: JULY 06, 2017

S2.08A
3

ADDENDA PACKAGE

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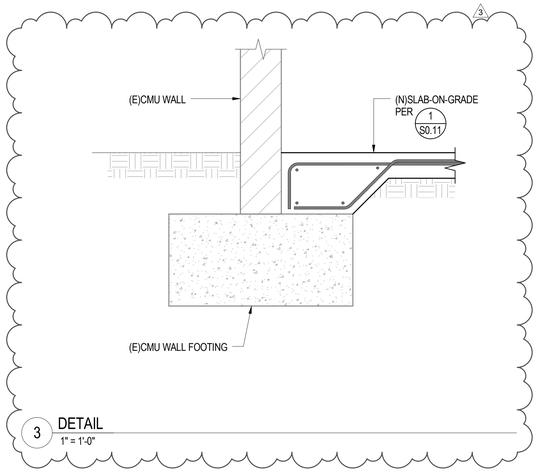
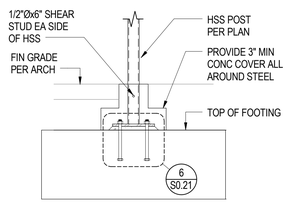
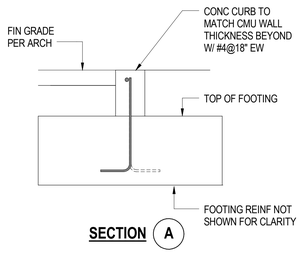


3 DETAIL
1" = 1'-0"

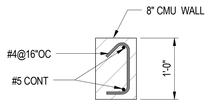


SECTION B

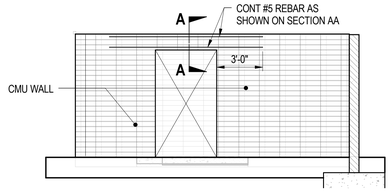


SECTION A

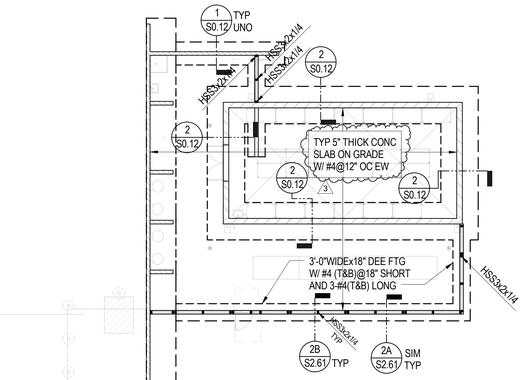
2 SECTIONS
3/4" = 1'-0"

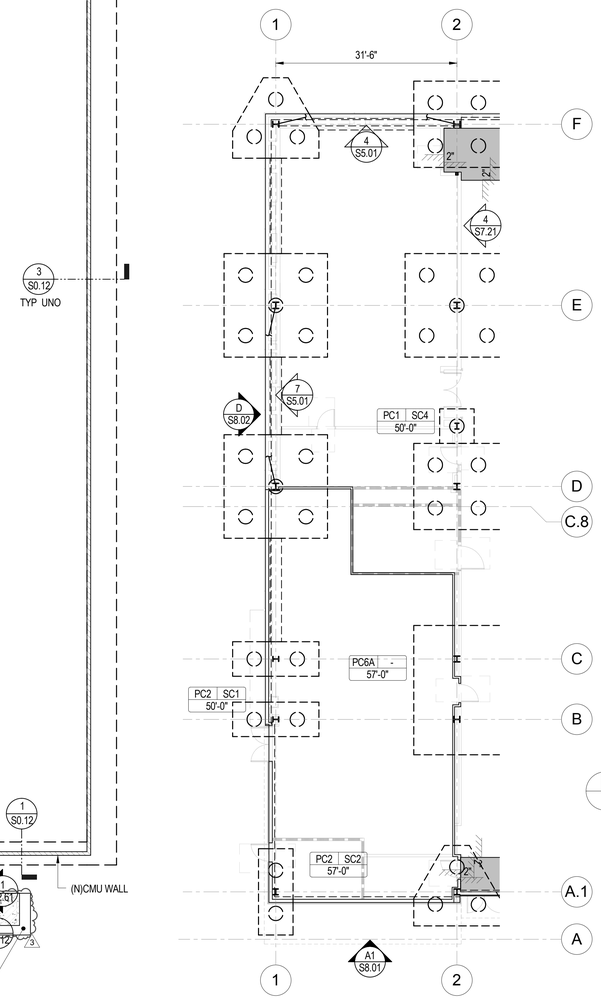


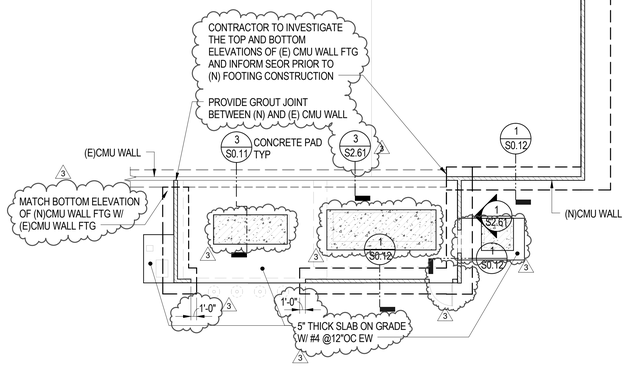
SECTION - AA



1 WALL ELEVATION
1/4" = 1'-0"







A LEVEL 01 GREEN HOUSE FOUNDATION PLAN
3/32" = 1'-0"

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1530 W. 17TH ST.
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SANTA ANA COLLEGE

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NAME: YENG KEONG LOW
DATE: DECEMBER 31 2018
REGISTRATION NUMBER: S4093

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

GREEN HOUSE FOUNDATION PLAN AND DETAILS

DATE: JULY 06, 2017

S2.61

ADDENDA PACKAGE

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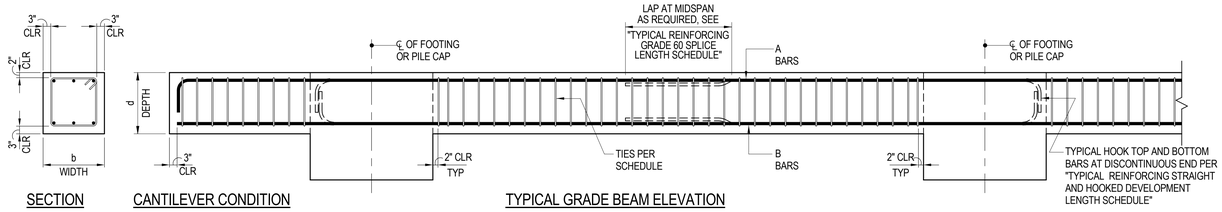


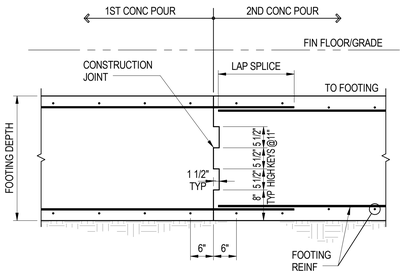
SECTION CANTILEVER CONDITION TYPICAL GRADE BEAM ELEVATION

NOTE:
TOP OF GRADE BEAM SHALL BE FLUSH WITH TOP OF FOOTING OR PILE CAP, UNLESS NOTED OTHERWISE.

GRADE BEAM SCHEDULE						
MARK	SIZE (INCHES)		PRIMARY LONGITUDINAL REINFORCING		TIES	REMARKS
	WIDTH b	DEPTH d	A BARS	B BARS		
GB1	24	24	4-#10	4-#10	#4@9"(2 LEGS)	
GB2	24	24	4-#9	4-#9	#4@9"(2 LEGS)	

3 TYPICAL GRADE BEAM SCHEDULE AND DETAILS
NTS

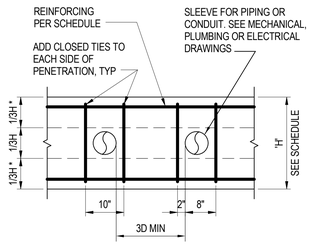
CONC-FNDN-0005



NOTE:
AS AN ALTERNATIVE, TYPE II ERICO COUPLERS OF ICC-ER 3967 MAY BE USED IN LIEU OF LAP SPLICES.

5 TYPICAL CONTINUOUS FOOTING CONSTRUCTION JOINT DETAIL
NTS

CONC-FNDN-0004

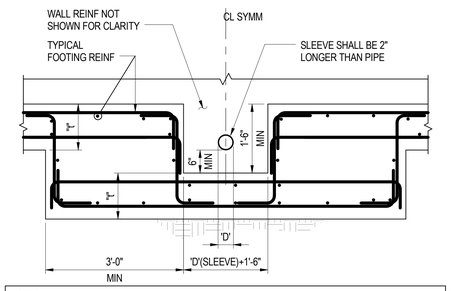


* NO PENETRATIONS ALLOWED IN THIS AREA.

7 TYPICAL PIPE/ CONDUIT THRU GRADE BEAM DETAIL
3/4" = 1'-0"

CONC-FNDN-0011

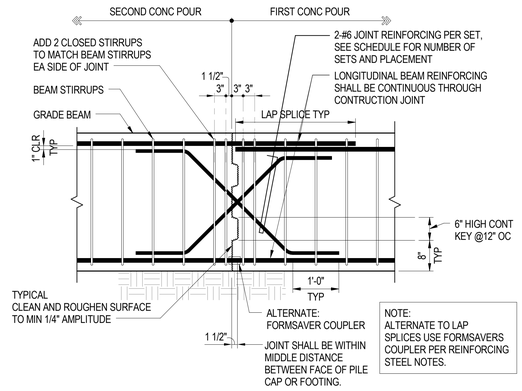
SCHEDULE	
BEAM WIDTH b	JOINT REINFORCING
b ≤ 8"	1 SET PLACE IN THE MIDDLE OF BEAM
8 < b ≤ 24"	1 SET EA SIDE OF BEAM
24 < b ≤ 40"	2 SETS EA SIDE OF BEAM (PLACE SETS @3" AT EA SIDE)
b > 40	1 SET @12" ACROSS BEAM WIDTH



NOTES:
1. WHERE FOOTING INTERFERES WITH PIPING, FOOTING SHALL BE DROPPED SO PIPING WILL PASS THRU WALL.
2. PROVIDE MIN 1" COMPRESSIBLE MATERIAL ALL AROUND PIPE AND WALL.

6 TYPICAL DROPPED WALL FOOTING AT PIPING DETAIL
3/4" = 1'-0"

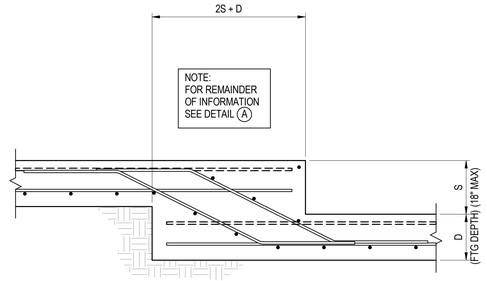
CONC-FNDN-0009



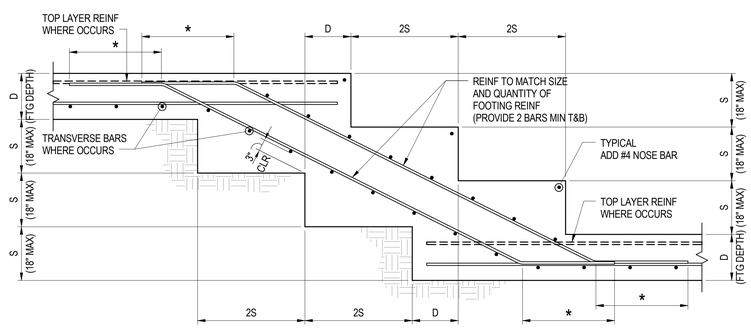
NOTE:
ALTERNATE TO LAP SPLICES USE FORMSAVERS COUPLER PER REINFORCING STEEL NOTES.

BEAM ELEVATION

4 TYPICAL GRADE BEAM CONSTRUCTION JOINT DETAIL
3/4" = 1'-0"



SHALLOW SLOPE CONDITION (B)

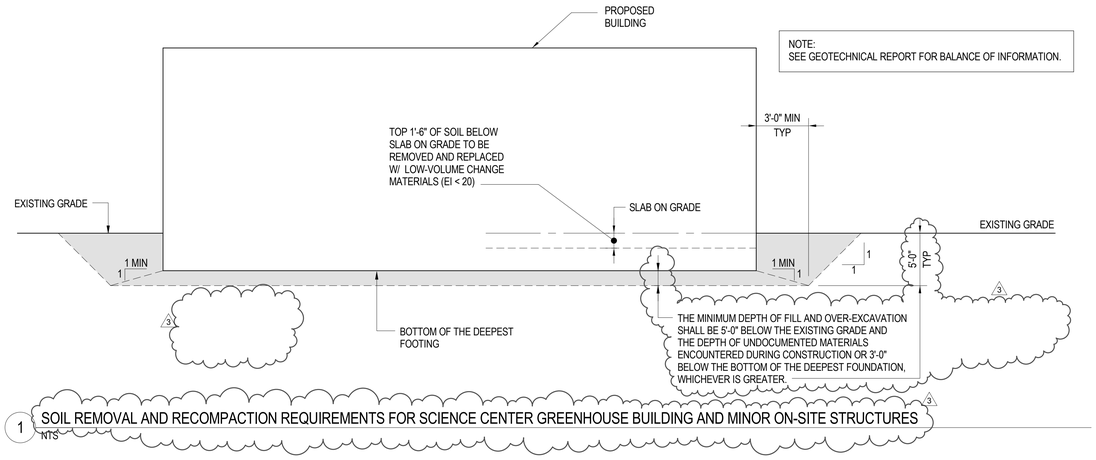


STEEP SLOPE CONDITION (A)

* STANDARD LAP PER "TYPICAL REINF GRADE 60 SPLICE LENGTH SCHEDULE"

2 TYPICAL STEPPED FOOTING DETAILS
NTS

CONC-FNDN-0003



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REGISTERED PROFESSIONAL ENGINEER YENG KEONG LOW No. 54093 Exp. 12/31/18 STRUCTURAL STATE OF CALIFORNIA

LICENSED ARCHITECT YENG KEONG LOW No. C-30135 RENEWAL DATE DECEMBER 31, 2017 STATE OF CALIFORNIA

NAME: YENG KEONG LOW
DATE: DECEMBER 31 2018
REGISTRATION NUMBER: 54093

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

FOUNDATION SCHEDULE AND DETAILS

DATE: JULY 06, 2017

S3.01

ADDENDA PACKAGE

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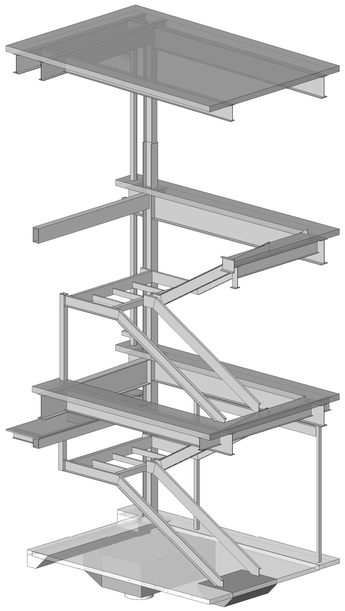
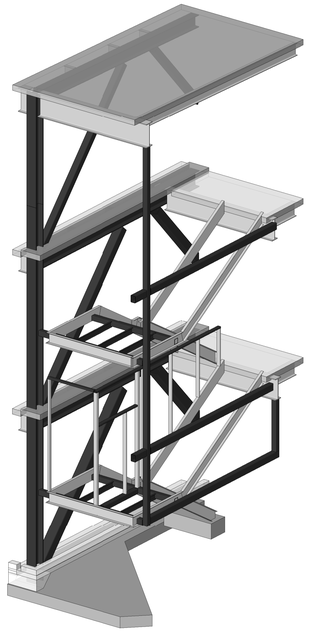


3 STAIR 3 ISOMETRIC VIEW



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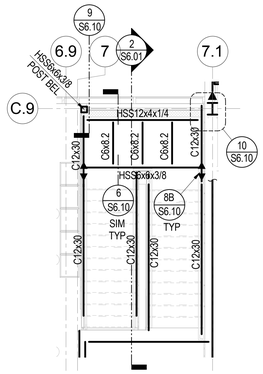
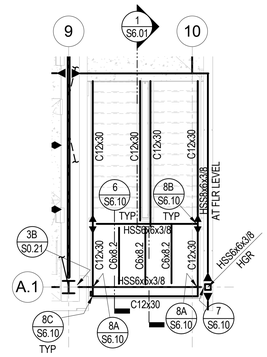


B2 LEVEL 03 ENLARGED STAIR 3 FRAMING PLAN
3/16" = 1'-0"



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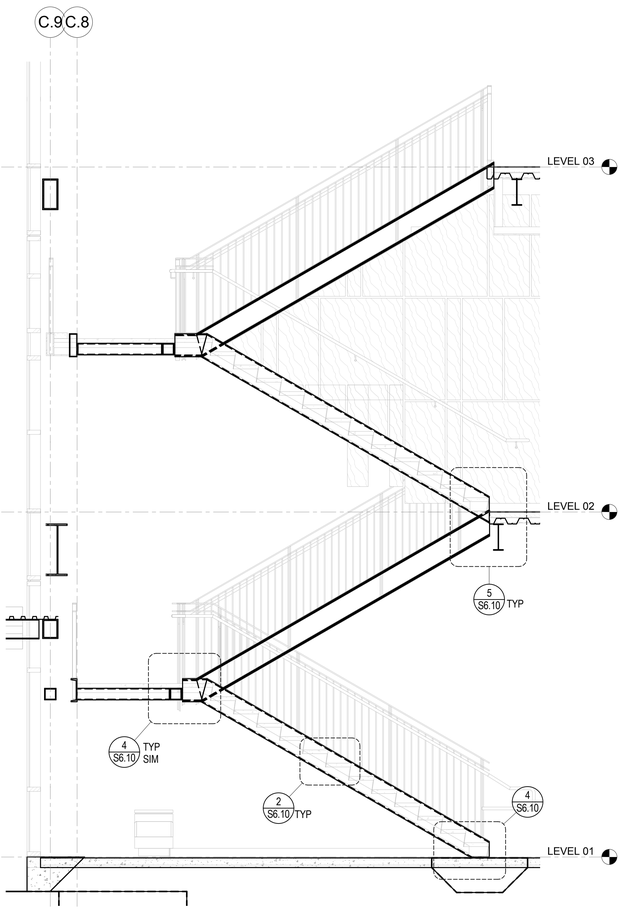
3/16" = 1'-0"



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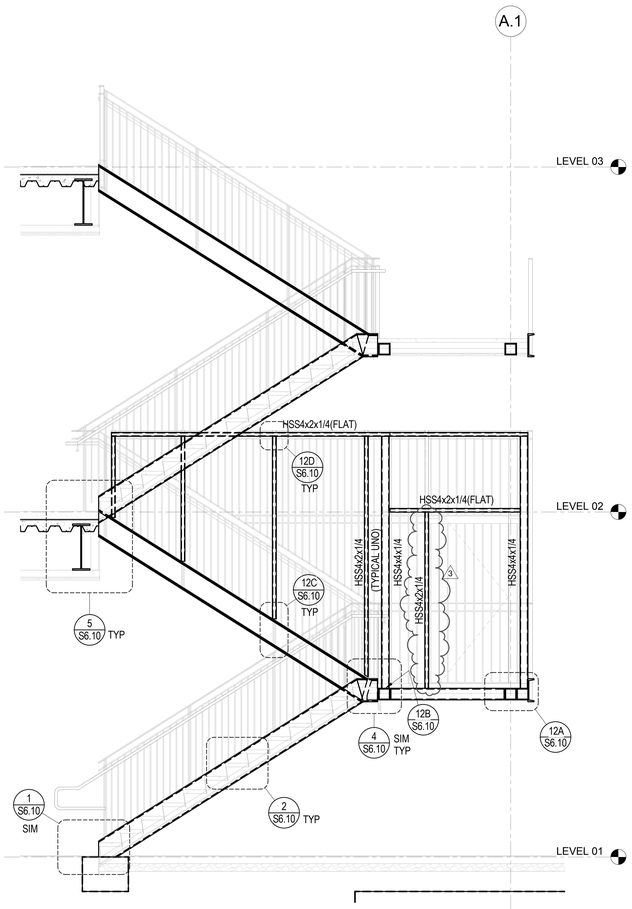

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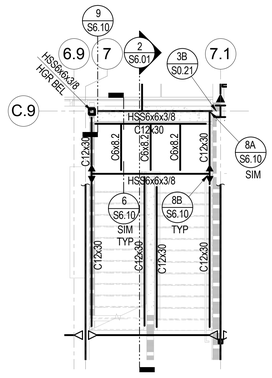
3/8" = 1'-0"



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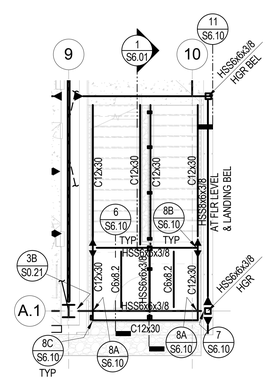

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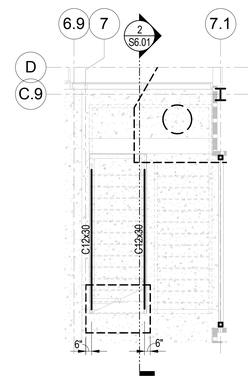
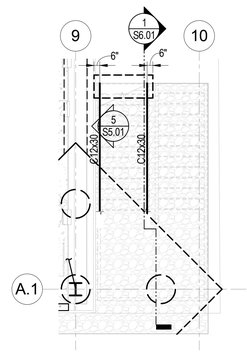


B LEVEL 01 ENLARGED STAIR 3 FOUNDATION PLAN
3/16" = 1'-0"



A LEVEL 01 ENLARGED STAIR 2 FOUNDATION PLAN
3/16" = 1'-0"

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REGISTERED PROFESSIONAL ENGINEER YEONG KEONG LOW No. 54093 Exp. 12/31/18 STRUCTURAL STATE OF CALIFORNIA

NAME: YEONG KEONG LOW
DATE: DECEMBER 31 2018
REGISTRATION NUMBER: 54093

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

ENLARGED STAIR PLANS

DATE: JULY 06, 2017

S6.01

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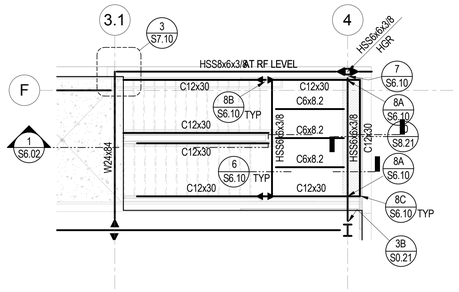
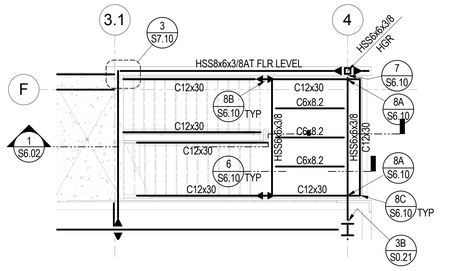


A3 ROOF LEVEL ENLARGED STAIR 1 FRAMING PLAN
3/16" = 1'-0"



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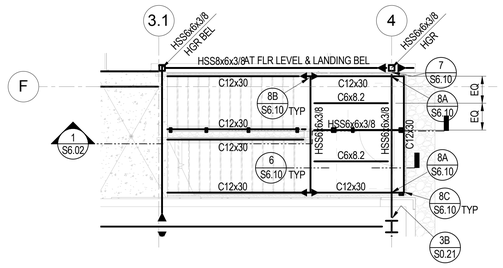

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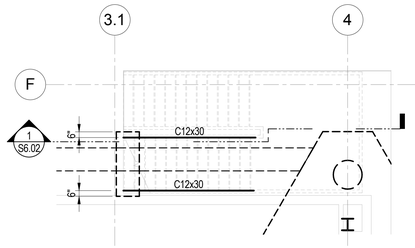

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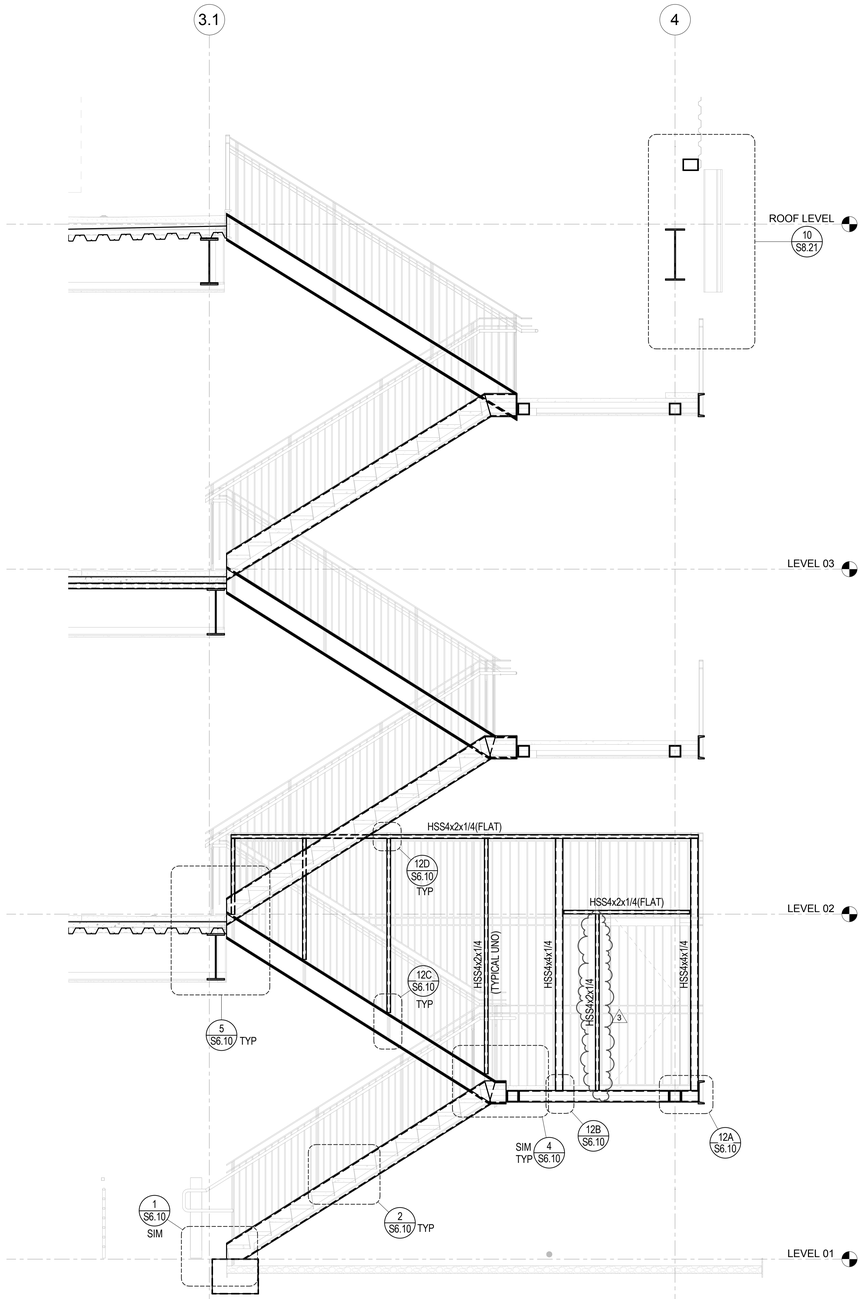
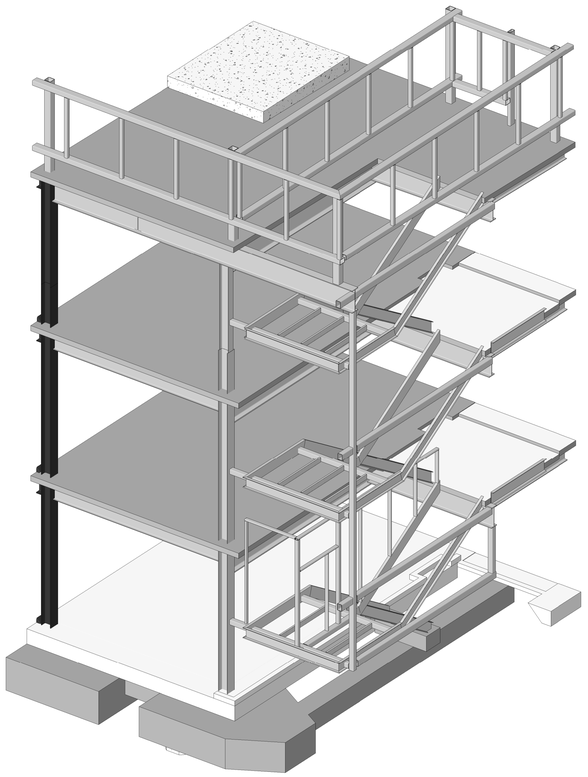
3/16" = 1'-0"



1 SECTION@STAIR 1
3/8" = 1'-0"



1A STAIR 1 ISOMETRIC VIEW

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NAME: YENG KEONG LOW
DATE: DECEMBER 31 2018
REGISTRATION NUMBER: S4093

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

ENLARGED STAIR PLANS

DATE: JULY 06, 2017

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VARIABLE FREQUENCY DRIVE SCHEDULE

ITEM	MANUFACTURER & MODEL NO.	LOCATION	EQUIPMENT SERVED	VFD HP	VOLT	PH	HZ	NOTES
VFD-AH-1S1	ABB	ROOF	AHU-1	15	460	3	60	NEMA-3R, IN AHU-1 ENCLOSURE
VFD-AH-1S2	ABB	ROOF	AHU-1	15	460	3	60	NEMA-3R, IN AHU-1 ENCLOSURE
VFD-AH-1S3	ABB	ROOF	AHU-1	15	460	3	60	NEMA-3R, IN AHU-1 ENCLOSURE
VFD-AH-1S4	ABB	ROOF	AHU-1	15	460	3	60	NEMA-3R, IN AHU-1 ENCLOSURE
VFD-AH-1R1	ABB	ROOF	AHU-1	5	460	3	60	NEMA-3R, IN AHU-1 ENCLOSURE
VFD-AH-2S1	ABB	ROOF	AHU-2	7.5	460	3	60	NEMA-3R, IN AHU-2 ENCLOSURE
VFD-AH-2S2	ABB	ROOF	AHU-2	7.5	460	3	60	NEMA-3R, IN AHU-2 ENCLOSURE
VFD-AH-2S3	ABB	ROOF	AHU-2	7.5	460	3	60	NEMA-3R, IN AHU-2 ENCLOSURE
VFD-AH-2S4	ABB	ROOF	AHU-2	7.5	460	3	60	NEMA-3R, IN AHU-2 ENCLOSURE
VFD-AH-2R1	ABB	ROOF	AHU-2	2	460	3	60	NEMA-3R, IN AHU-2 ENCLOSURE
VFD-AH-3S1	ABB	ROOF	AHU-3	15	460	3	60	NEMA-3R, IN AHU-3 ENCLOSURE
VFD-AH-3S2	ABB	ROOF	AHU-3	15	460	3	60	NEMA-3R, IN AHU-3 ENCLOSURE
VFD-AH-3R1	ABB	ROOF	AHU-3	7.5	460	3	60	NEMA-3R, IN AHU-3 ENCLOSURE
VFD-EF-1	ABB	ROOF	EF-1	20	460	3	60	NEMA-3R, IN ENCLOSURE
VFD-EF-2	ABB	ROOF	EF-2	20	460	3	60	NEMA-3R, IN ENCLOSURE
VFD-EF-3	ABB	ROOF	EF-3	20	460	3	60	NEMA-3R, IN ENCLOSURE
VFD-EF-4	ABB	ROOF	EF-4	20	460	3	60	NEMA-3R, IN ENCLOSURE
VFD-TEF-1	ABB	ROOF	TEF-1	2	460	3	60	NEMA-3R, IN ENCLOSURE, PROVIDE WITH STANCHION FOR SUPPORT
VFD-HHWP-1	ABB	MECHANICAL SC128	HHWP-1	3	460	3	60	NEMA-3R
VFD-HHWP-2	ABB	MECHANICAL SC128	HHWP-2	3	460	3	60	NEMA-3R

VARIABLE AIR VOLUME BOXES SCHEDULE

ITEM	MANUFACTURER & MODEL NO.	AREA SERVED	SYSTEM SERVED	INLET SIZE (IN.)	AIRFLOW MAXIMUM (CFM)	AIRFLOW 6 ACH MINIMUM (CFM)	AIRFLOW MINIMUM/ 4 ACH (CFM)	MAX. PRESS DROP (IN. W.C.)	HEATING COIL TOTAL HEATING (MBH)	HEATING AIR FLOW (CFM)	WATER TEMP. ENT. (°F)	WATER TEMP. LVG. (°F)	AIR TEMP. ENT. (°F)	AIR TEMP. LVG. (°F)	FLOW RATE (GPM) MIN. 0.5	MAX. PRESSURE DROP AIR (IN. W.C.)	MAX. PRESSURE DROP WATER (FT. W.C.)	NO. OF ROWS	2-WAY OR 3-WAY CONTROL VALVE	BRANCH PIPE SIZE (IN.)	MAX. NC RADIATED	MAX. NC DISCHARGE	OPERATING WEIGHT (LBS)	ANCHORAGE DETAIL	NOTES
CAV-103	PRICE SDV5	SC100	AHU-1	8	370	NA	370	0.6	22.6	370	160	110	55	95.5	1.0	0.43	0.32	3	2-WAY	3/4	–	–	50	#10/M6.09	–
VAV-104	PRICE SDV5	SC115	AHU-1	12	1,420	NA	590	0.6	23.5	590	160	107	55	90.7	0.9	0.54	0.35	2	2-WAY	3/4	–	–	64	#10/M6.09	–
VAV-105	PRICE SDV5	SC113-2	AHU-1	10	1,040	NA	470	0.6	15.7	470	160	141	55	84.9	1.7	0.29	1.9	1 HC	2-WAY	3/4	–	–	52	#10/M6.09	–
VAV-106	PRICE SDV5	SC113-1	AHU-2	10	880	NA	465	0.6	13.2	465	160	129	55	80.4	0.9	0.22	0.66	1 HC	2-WAY	3/4	–	–	52	#10/M6.09	–
VAV-107	PRICE SDV5	SC111	AHU-2	14	2,000	NA	960	0.6	33.9	960	160	102	55	86.6	1.2	0.50	0.30	2	2-WAY	3/4	–	–	81	#10/M6.09	–
CAV-108	PRICE SDV5	SC100	AHU-1	10	760	NA	760	0.6	35.7	760	160	132	55	97.1	2.6	0.36	1.61	2 HC	2-WAY	3/4	–	–	54	#10/M6.09	–
VAV-109	PRICE SDV5	SC124	AHU-1	4	120	NA	50	0.6	5.5	120	160	149	55	96.1	1.0	0.02	0.48	1 HC	2-WAY	3/4	–	–	37	#10/M6.09	–
CAV-110	PRICE SDV5	SC122	AHU-1	12	1,240	NA	1,240	0.6	37.1	1,240	160	108	55	81.8	1.5	0.42	0.76	2	2-WAY	3/4	–	–	64	#10/M6.09	–
CAV-111	PRICE SDV5	SC122	AHU-1	12	1,240	NA	1,240	0.6	37.1	1,240	160	108	55	81.8	1.5	0.42	0.76	2	2-WAY	3/4	–	–	64	#10/M6.09	–
VAV-112	PRICE SDV5	SC120	AHU-1	8	880	NA	360	0.6	12.5	360	160	150	55	86.1	2.7	0.42	2.85	1 HC	2-WAY	3/4	–	–	44	#10/M6.09	–
VAV-113	PRICE SDV5	SC118	AHU-3	14	2,000	NA	715	0.6	25.8	715	160	133	55	87.3	2.0	0.27	3.93	1 HC	2-WAY	3/4	–	–	76	#10/M6.09	–
VAV-114	PRICE SDV5	SC105	AHU-3	14	1,600	NA	780	0.6	29.1	780	160	100	55	88.4	1.0	0.34	0.22	2	2-WAY	3/4	–	–	81	#10/M6.09	–
VAV-115	PRICE SDV5	SC103	AHU-3	14	1,950	NA	1,000	0.6	56.1	1,200	160	130	55	96.9	3.8	0.48	2.06	2	2-WAY	1	–	–	81	#10/M6.09	–
VAV-116	PRICE SDV5	SC103-2	AHU-3	6	360	NA	110	0.6	6.9	180	160	147	55	89.4	1.2	0.15	0.55	1 HC	3-WAY	3/4	–	–	36	#10/M6.09	–
CAV-117	PRICE SDV5	SC100-1	AHU-3	6	420	NA	420	0.6	15.9	420	160	125	55	83.2	0.8	0.35	0.13	2	2-WAY	3/4	–	–	38	#10/M6.09	–
VAV-118	PRICE SDV5	SC116	AHU-3	6	240	NA	70	0.6	4.2	110	160	135	55	89.1	0.5	0.06	0.15	1 HC	2-WAY	3/4	–	–	36	#10/M6.09	–
VAV-119	PRICE SDV5	SC116-1	AHU-3	6	360	NA	110	0.6	7.5	180	160	152	55	92.3	2.1	0.15	1.48	1 HC	2-WAY	3/4	–	–	36	#10/M6.09	–
VAV-120	PRICE SDV5	SC110-1 SC110-2	AHU-3	8	420	NA	130	0.6	7.3	210	160	143	55	86.1	1.0	0.10	0.52	1	2-WAY	3/4	–	–	52	#10/M6.09	–
VAV-121	PRICE SDV5	SC110-3 SC110-4	AHU-3	8	700	NA	210	0.6	11.7	350	160	147	55	85.0	1.8	0.28	1.56	1	2-WAY	3/4	–	–	44	#10/M6.09	–
CAV-203	PRICE SDV5	SC200	AHU-1	8	460	NA	460	0.6	19.2	460	160	141	55	92.4	1.4	0.25	0.45	2	2-WAY	3/4	–	–	46	#10/M6.09	–
CAV-204	PRICE SDV5	SC200	AHU-2	8	540	NA	540	0.6	17.6	540	160	115	55	84.2	0.8	0.38	0.18	2 HC	2-WAY	3/4	–	–	46	#10/M6.09	–
VAV-214	PRICE SDV5	SC207, SC209 SC200-1	AHU-3	12	1,500	NA	820	0.6	38.2	820	160	129	55	96.7	2.5	0.52	1.85	2	2-WAY	3/4	–	–	64	#10/M6.09	–
VAV-215	PRICE SDV5	SC205	AHU-3	6	340	NA	140	0.6	11.3	240	160	134	55	97.2	0.9	0.24	0.17	2	2-WAY	3/4	–	–	38	#10/M6.09	–
VAV-216	PRICE SDV5	SC201	AHU-3	8	420	NA	300	0.6	8.8	300	160	142	55	81.3	1.0	0.10	0.61	1	2-WAY	3/4	–	–	44	#10/M6.09	–
VAV-217	PRICE SDV5	SC201-7	AHU-3	4	180	NA	120	0.6	4.8	120	160	140	55	90.8	0.5	0.04	0.34	1 HC	2-WAY	3/4	–	–	37	#10/M6.09	–
VAV-218	PRICE SDV5	SC201-4 SC201-5 SC201-6	AHU-3	8	420	NA	300	0.6	11.4	300	160	151	55	89.0	2.7	0.12	2.84	1 HC	2-WAY	3/4	–	–	44	#10/M6.09	–
VAV-219	PRICE SDV5	SC201-3	AHU-3	6	220	NA	150	0.6	5.8	150	160	143	55	89.7	0.7	0.05	0.76	1 HC	3-WAY	3/4	–	–	36	#10/M6.09	–
VAV-220	PRICE SDV5	SC201-1	AHU-3	4	120	NA	85	0.6	3.7	85	160	145	55	93.6	0.5	0.02	0.15	1	2-WAY	3/4	–	–	37	#10/M6.09	–
VAV-221	PRICE SDV5	SC201-2	AHU-3	6	220	NA	150	0.6	5.8	150	160	151	55	89.6	0.7	0.06	0.27	1 HC	2-WAY	3/4	–	–	36	#10/M6.09	–
CAV-222	PRICE SDV5	SC200-1	AHU-3	6	330	NA	330	0.6	16.4	330	160	138	55	98.2	1.5	0.28	0.41	2	2-WAY	3/4	–	–	38	#10/M6.09	–
VAV-223	PRICE SDV5	SC208	AHU-3	12	1,440	NA	580	0.6	25.8	580	160	114	55	94.9	1.2	0.55	0.52	2	2-WAY	3/4	–	–	64	#10/M6.09	–
CAV-302	PRICE SDV5	SC300	AHU-1	8	660	NA	660	0.6	31.7	660	160	145	55	98.0	4.5	0.54	3.24	2	2-WAY	1	–	–	46	#10/M6.09	–
CAV-304	PRICE SDV5	SC300	AHU-2	8	500	NA	500	0.6	16.6	500	160	120	55	84.7	0.9	0.29	0.19	2	2-WAY	3/4	–	–	46	#10/M6.09	–
VAV-312	PRICE SDV5	SC314	AHU-3	6	440	NA	370	0.6	12.1	370	160	123	55	84.3	0.7	0.38	0.11	2	2-WAY	1	–	–	38	#10/M6.09	–
VAV-313	PRICE SDV5	SC312	AHU-3	14	2,060	NA	710	0.6	30.3	710	160	107	55	93.2	1.2	0.53	0.29	2	2-WAY	3/4	–	–	81	#10/M6.09	–
VAV-314	PRICE SDV5	SC300-1	AHU-3	10	940	NA	280	0.6	43.4	900	160	140	55	98.2	4.5	0.52	4.04	2	2-WAY	1	–	–	54	#10/M6.09	–
VAV-315	PRICE SDV5	SC305	AHU-3	6	340	NA	140	0.6	11.3	240	160	134	55	97.2	0.9	0.24	0.17	2	2-WAY	3/4	–	–	38	#10/M6.09	–
VAV-316	PRICE SDV5	SC301	AHU-3	8	420	NA	300	0.6	8.8	300	160	142	55	81.3	1.0	0.10	0.61	1	2-WAY	3/4	–	–	44	#10/M6.09	–
VAV-317	PRICE SDV5	SC301-7	AHU-3	4	180	NA	120	0.6	4.8	120	160	140	55	90.8	0.5	0.04	0.34	1 HC	2-WAY	3/4	–	–	37	#10/M6.09	–
VAV-318	PRICE SDV5	SC301-4 SC301-5 SC301-6	AHU-3	8	420	NA	300	0.6	11.4	300	160	151	55	89.0	2.7	0.12	2.84	1 HC	2-WAY	3/4	–	–	44	#10/M6.09	–
VAV-319	PRICE SDV5	SC301-3	AHU-3	6	220	NA	150	0.6	5.8	150	160	143	55	89.7	0.7	0.05	0.76	1 HC	3-WAY	3/4	–	–	36	#10/M6.09	–
VAV-320	PRICE SDV5	SC301-1	AHU-3	4	120	NA	85	0.6	3.7	85	160	145	55	93.6	0.5	0.02	0.15	1	2-WAY	3/4	–	–	37	#10/M6.09	–
VAV-321	PRICE SDV5	SC301-2	AHU-3	6	220	NA	150	0.6	5.8	150	160	151	55	89.6	0.7	0.06	0.27	1 HC	2-WAY	3/4	–	–	36	#10/M6.09	–
CAV-322	PRICE SDV5	SC300-1	AHU-3	6	330	NA	330	0.6	13.3	330	160	132	55	91.1	1.0	0.23	0.20	2	2-WAY	3/4	–	–	38	#10/M6.09	–
VAV-323	PRICE SDV5	SC308	AHU-3	12	1,440	NA	580	0.6	25.8	580	160	114	55	94.9	1.2	0.55	0.52	2	2-WAY	3/4	–	–	64	#10/M6.09	–

NOTE: PROVIDE WITH 120V POWER. UNIT WITH 24V TRANSFORMER.

FAN POWERED BOXES SCHEDULE

ITEM	MANUFACTURER & MODEL NO.	SERVED BY	AREA SERVED	PRIMARY AIRFLOW (CFM)	FAN TOTAL AIRFLOW (CFM)	STATIC PRESSURE INLET	STATIC PRESSURE DOWN STREAM	MOTOR DATA HP	VOLT	PH	HZ	MAX DISCHARGE NC	MAX RADIATED NC	OPERATING WEIGHT (LBS)	ANCHORAGE DETAIL	NOTES
FPTU-1	PRICE FDCG8-3010	AHU-3	SC102, SC104	230	980	0.75	0.25	1/4	115	1	60	22	25	85	#10/M6.09	FURNISH WITH DAS3 DISCHARGE ATTENUATOR AND IAS INLET ATTENUATOR
FPTU-2	PRICE FDCG8-3010	AHU-3	SC202, SC204	230	980	0.75	0.25	1/4	115	1	60	22	25	85	#10/M6.09	FURNISH WITH DAS3 DISCHARGE ATTENUATOR AND IAS INLET ATTENUATOR
FPTU-3	PRICE FDCG8-3010	AHU-3	SC302, SC304	230	980	0.75	0.25	1/4	115	1	60	22	25	85	#10/M6.09	FURNISH WITH DAS3 DISCHARGE ATTENUATOR AND IAS INLET ATTENUATOR

EXHAUST CONSTANT AIR VOLUME BOXES

ITEM	MANUFACTURER AND MODEL NO.	AREA SERVED	SYSTEM SERVED	INLET SIZE (IN.)	AIRFLOW MAXIMUM (CFM)	AIRFLOW MINIMUM (CFM)	MAX. PRESS DROP (IN. W.C.)	OPERATING WEIGHT (LBS)	ANCHORAGE DETAIL	NOTES
ECAV-311	PRICE SDE5	SC311	EF-1,2,3,4	4	100	100	0.6	15	N/A	–

NOTE: PROVIDE WITH 120V POWER. UNIT WITH 24V TRANSFORMER.

EXHAUST VARIABLE AIR VOLUME BOXES

ITEM	MANUFACTURER AND MODEL NO.	AREA SERVED	SYSTEM SERVED	INLET SIZE (IN.)	AIRFLOW MAXIMUM (CFM)	AIRFLOW MINIMUM (CFM)	MAX. PRESS DROP (IN. W.C.)	OPERATING WEIGHT (LBS)	ANCHORAGE DETAIL	NOTES
EVAV-214	PRICE SDE5	SC200-1	EF-1,2,3,4	12	1,525	745	0.6	50	#10/M6.09	–
EVAV-315	PRICE SDE5	SC300-1	EF-1,2,3,4	12	1,475	615	0.6	50	#10/M6.09	–

NOTE: PROVIDE WITH 120V POWER. UNIT WITH 24V TRANSFORMER.

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LICENSED ARCHITECT JAMES G. MATSON C-13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER JOHN GAUTREY No. M-29791 Exp. 06-30-2018 MECHANICAL STATE OF CALIFORNIA

NAME: JOHN GAUTREY
DATE: DECEMBER 16, 2016
REGISTRATION NUMBER: M-29791

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: REVIEW BY: JG

HGA NO: 3584-001-00

MECHANICAL SCHEDULES

DATE: JULY 06, 2017

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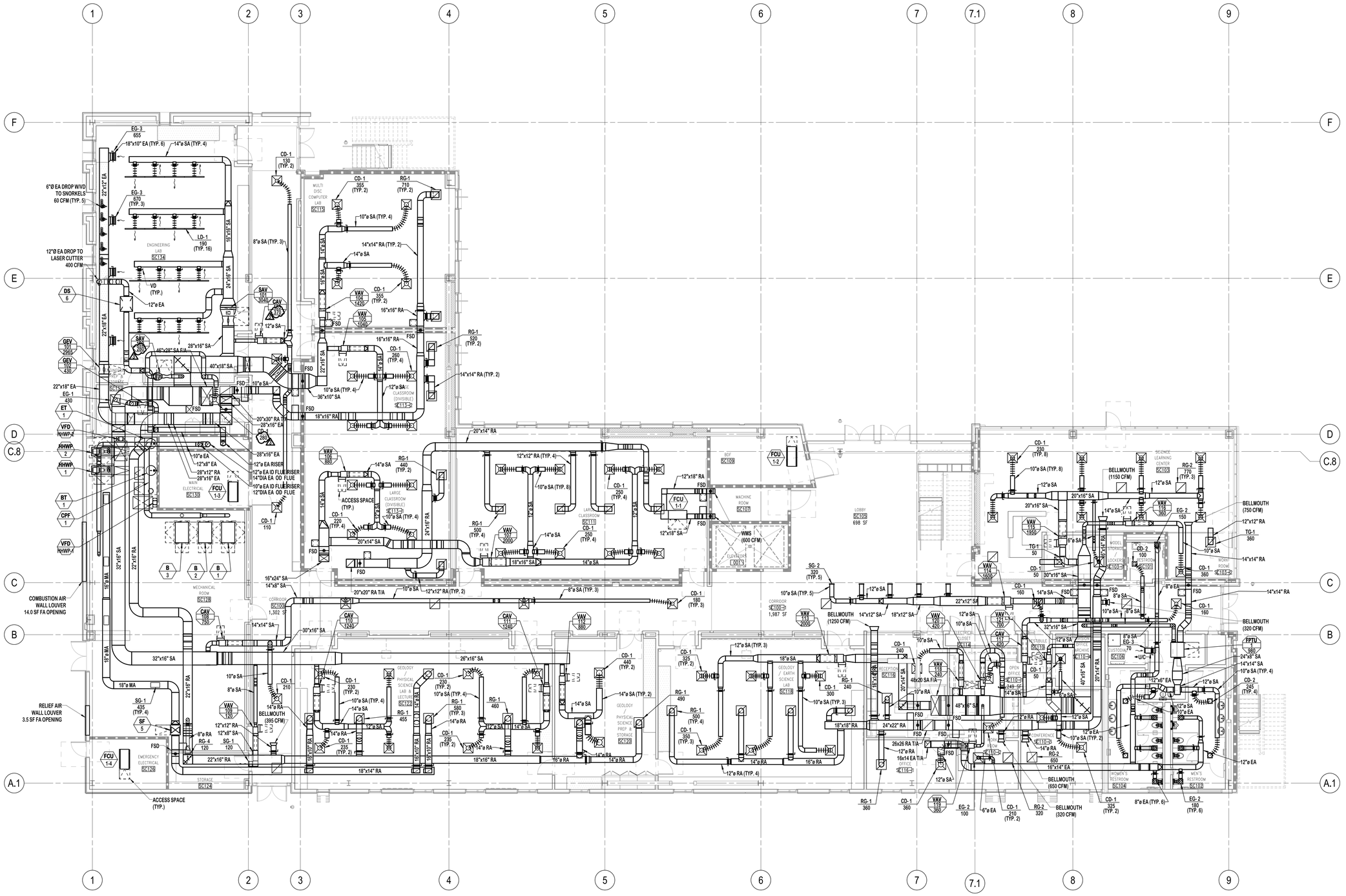

1 MECHANICAL FLOOR PLAN - LEVEL 01
1/8" = 1'-0"

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NAME: JOHN GAUTREY
DATE: DECEMBER 16, 2016
REGISTRATION NUMBER: M-29791

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: TY | REVIEW BY: JG

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FIRST LEVEL FLOOR PLAN

DATE: JULY 06, 2017

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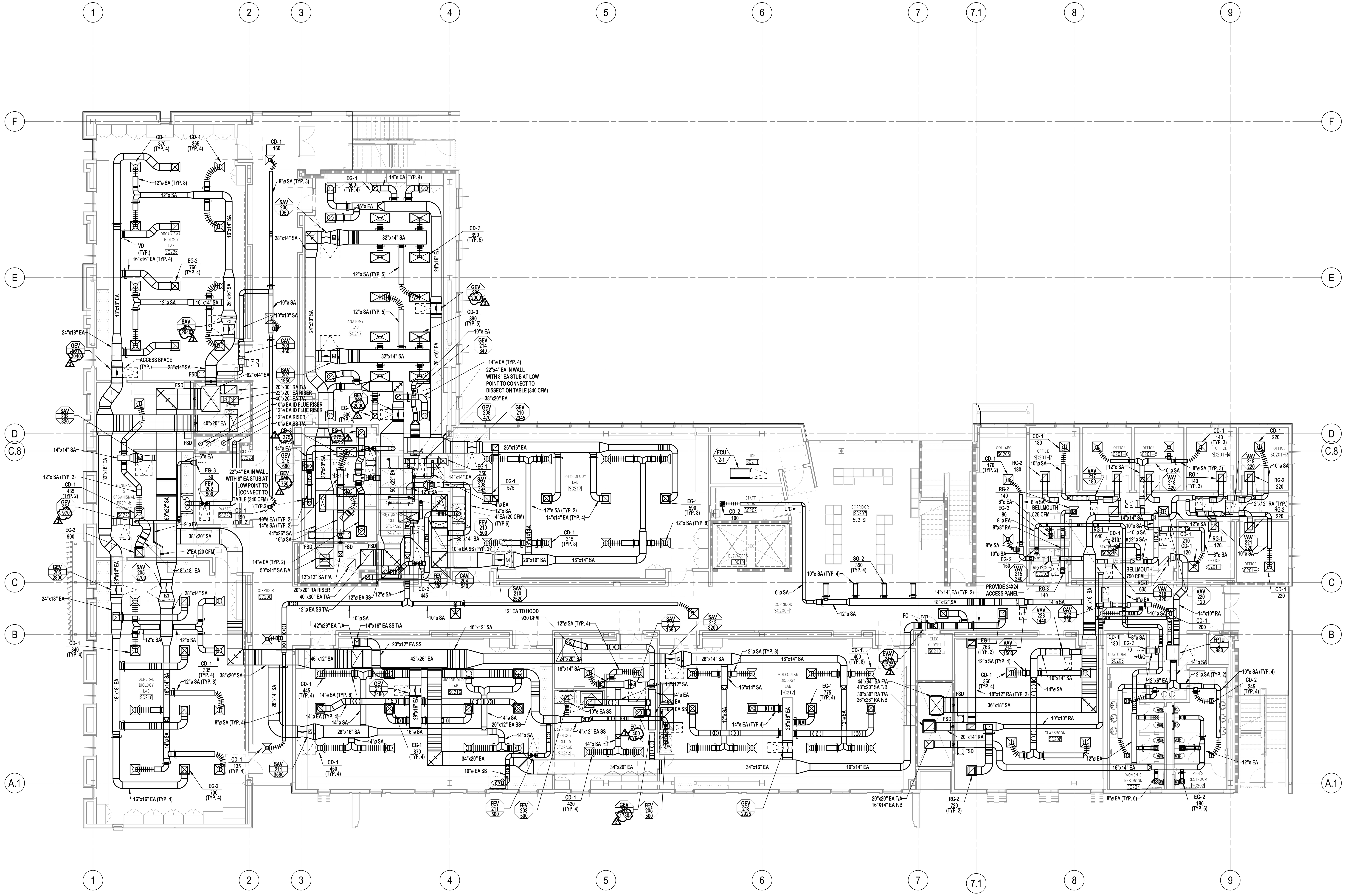

1 MECHANICAL PLAN - LEVEL 02
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NAME: JOHN GAUTREY
DATE: DECEMBER 16, 2016
REGISTRATION NUMBER: M-29791

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: TY | REVIEW BY: JG

HGA NO: 3584-001-00

SECOND LEVEL FLOOR PLAN

DATE: JULY 06, 2017

M2.02

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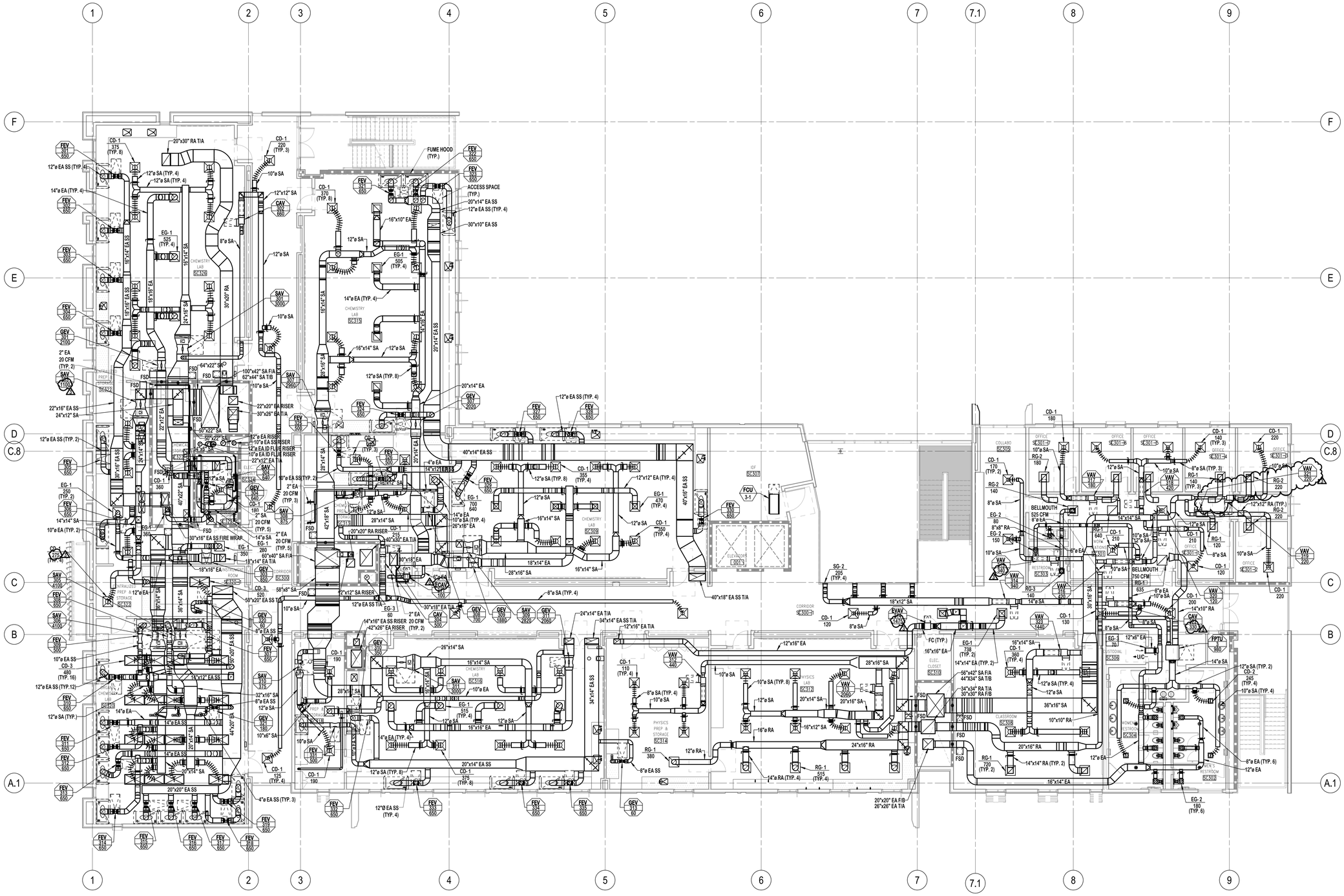

1 MECHANICAL FLOOR PLAN - LEVEL 03
1/8" = 1'-0"

HGA
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
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626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
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SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
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949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
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213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
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949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
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SAN DIEGO, CA 92103
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THIRD LEVEL FLOOR PLAN

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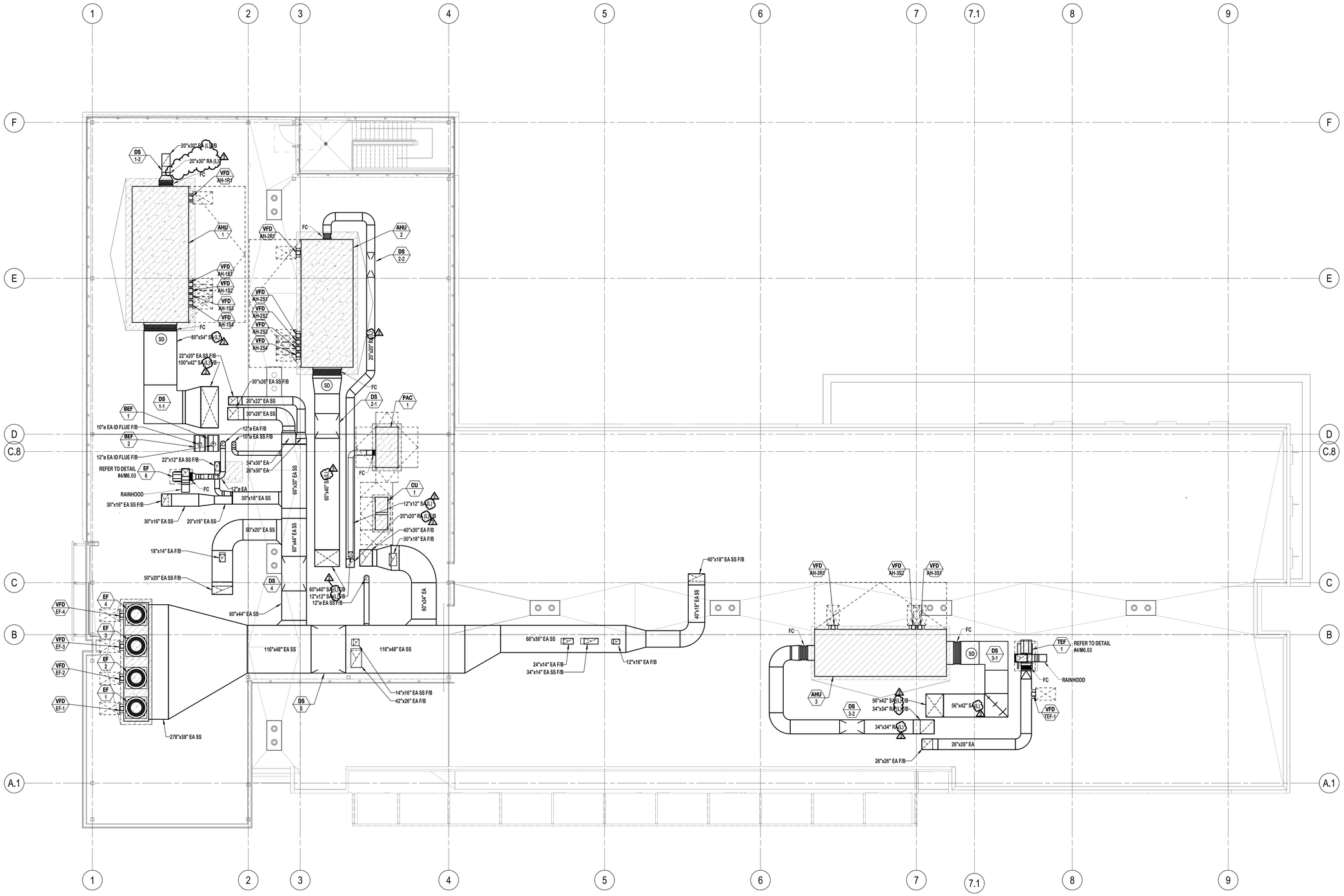

1 MECHANICA PLAN - ROOF
1/8" = 1'-0"

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ROOF PLAN

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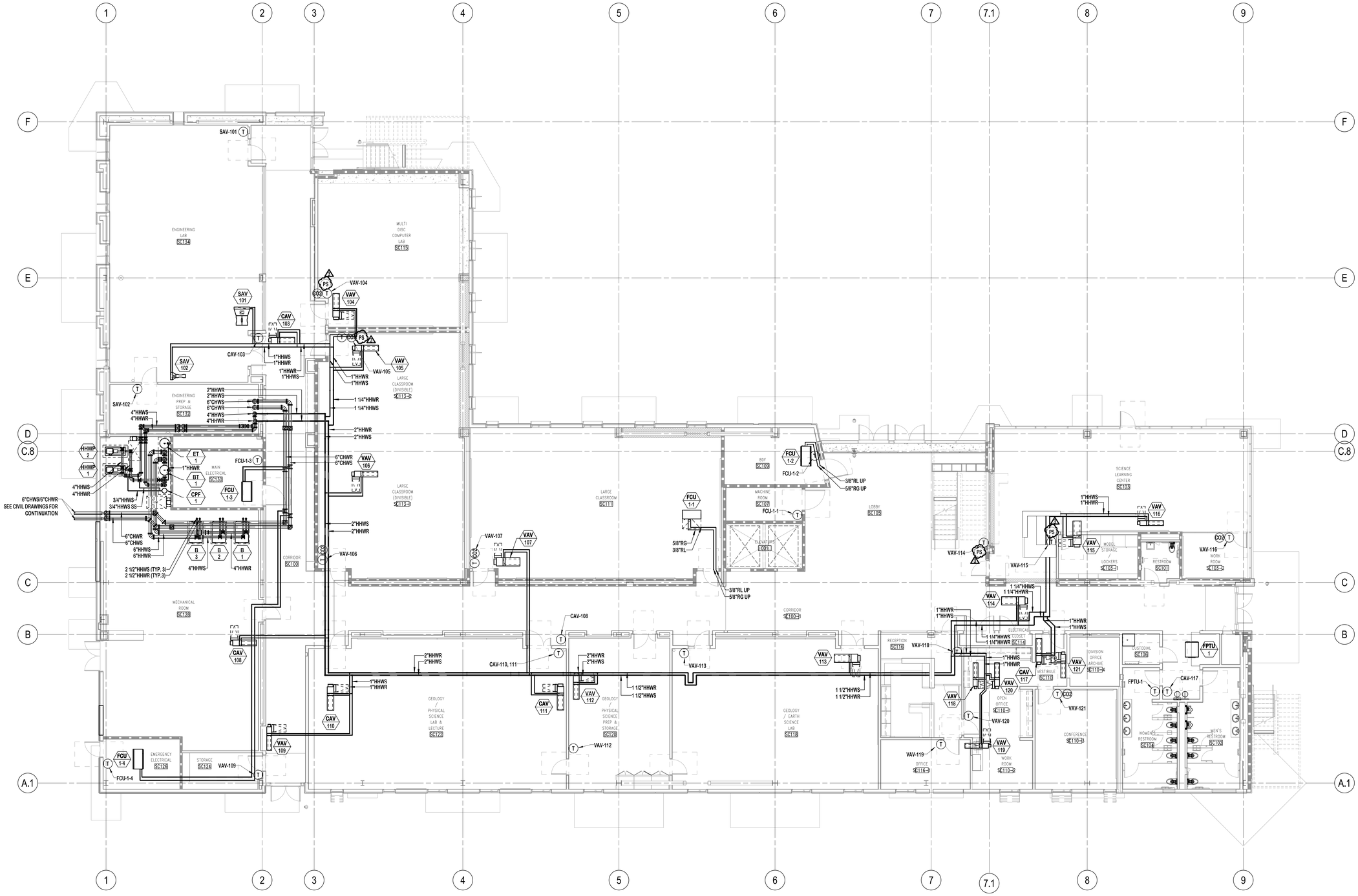

1 MECHANICAL PIPING FLOOR PLAN - LEVEL 01
1/8" = 1'-0"

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FIRST LEVEL PIPING PLAN

DATE: JULY 06, 2017

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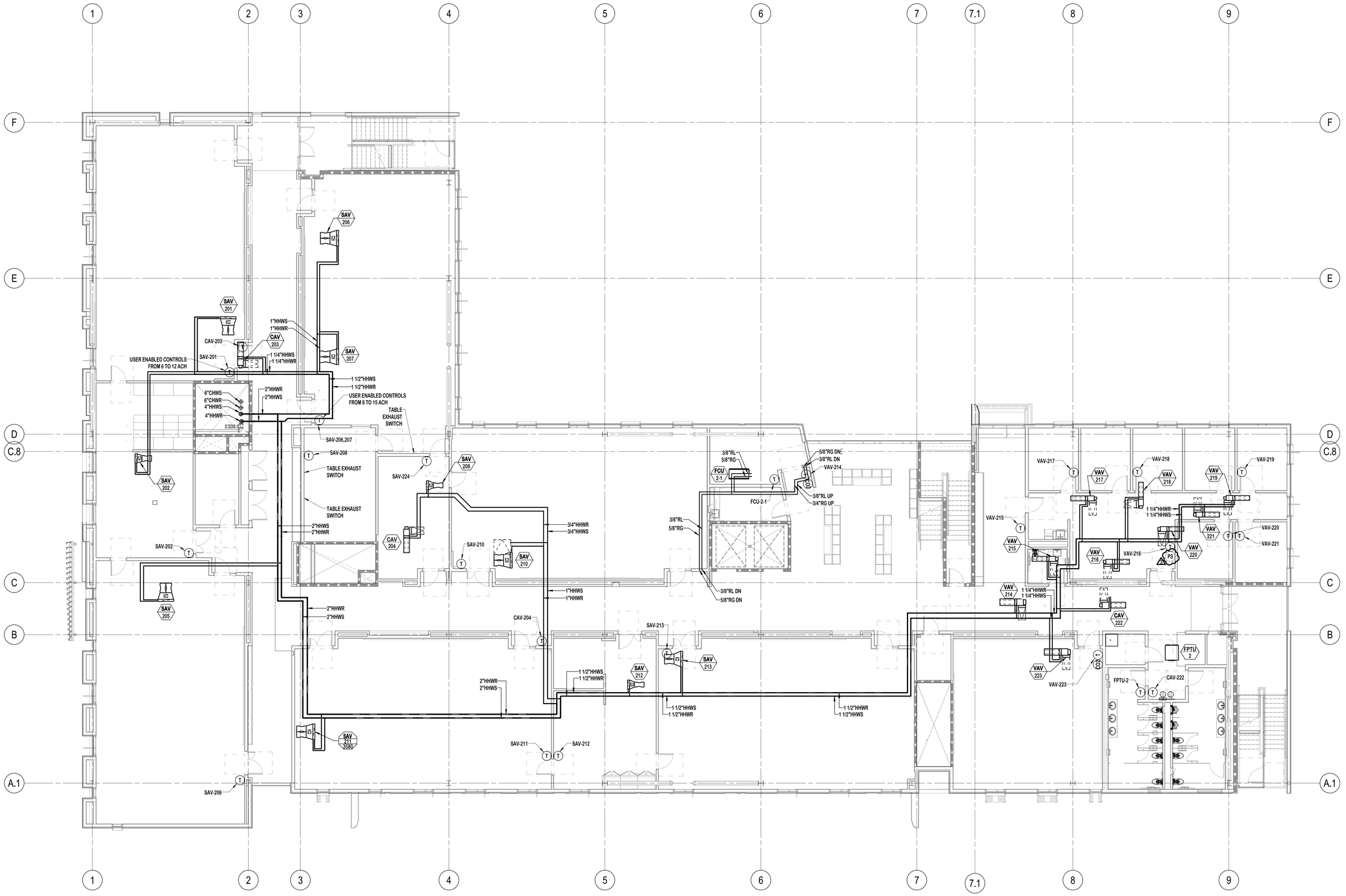

1 MECHANICAL PIPING FLOOR PLAN - LEVEL 02
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SECOND LEVEL PIPING PLAN

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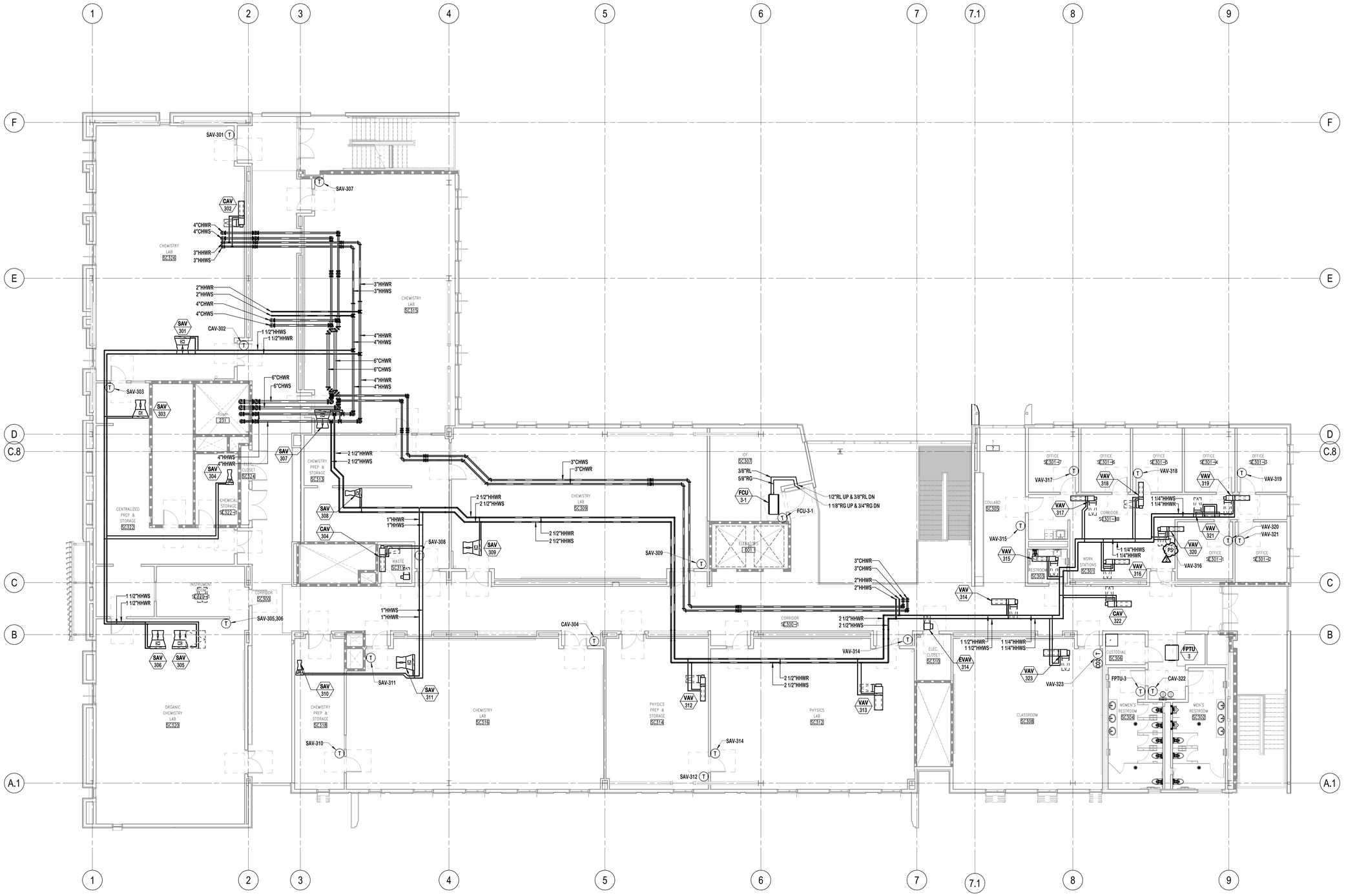

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THIRD LEVEL PIPING PLAN

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PLUMBING FIXTURE SCHEDULE

SYMBOL	FIXTURE	TRAP ARM	WASTE	VENT	CW	HW	REMARKS
WC-1	WATER CLOSET	INTEGRAL	4"	2"	1 1/2"	–	AMERICAN STANDARD 3351.128 "AFWALL" TOILET, ELONGATED WALL MOUNT, VITREOUS CHINA W/EVERCLEAN COATING, 1.28 GPF, WITH SLOAN OPTIMA EXPOSED SENSOR OPERATED ROYAL MODEL 111-1.128 ES-S TMO WATER CLOSET FLUSHOMETER VALVE WITH 120V/24 VAC TRANSFORMER (HARD WIRED) WITH MANUAL OVERRIDE, BEMIS COMMERCIAL OPEN FRONT LESS COVER MODEL 1055SSC.
WC-2	WATER CLOSET (ACCESSIBLE)	INTEGRAL	4"	2"	1 1/2"	–	AMERICAN STANDARD 3351.128 "AFWALL" TOILET, ELONGATED WALL MOUNT, VITREOUS CHINA W/EVERCLEAN COATING, 1.28 GPF, WITH SLOAN OPTIMA EXPOSED SENSOR OPERATED ROYAL MODEL 111-1.128 ES-S TMO WATER CLOSET FLUSHOMETER VALVE WITH 120V/24 VAC TRANSFORMER (HARD WIRED) WITH MANUAL OVERRIDE, BEMIS COMMERCIAL OPEN FRONT LESS COVER MODEL 1055SSC. ACCESSIBLE.
UR-1	URINAL	INTEGRAL	2"	2"	1"	–	AMERICAN STANDARD 6590.001 "WASHBROOK FLOWISE", WALL HUNG WITH ELONGATED RIM, VITREOUS CHINA, 0.125 GPF, WITH SLOAN OPTIMA EXPOSED SENSOR OPERATED ROYAL MODEL 186-0.125 ES-S TMO URINAL FLUSHOMETER VALVE WITH 120V/24 VAC TRANSFORMER (HARD WIRED). WALL HUNG WITH STAINLESS STEEL STRAINER, 0.125 GPF, SLOAN AUTOMATIC FLUSH (HARD WIRED) WITH MANUAL OVERRIDE.
UR-2	URINAL (ACCESSIBLE)	INTEGRAL	2"	2"	1"	–	AMERICAN STANDARD 6590.001 "WASHBROOK FLOWISE", WALL HUNG WITH ELONGATED RIM, VITREOUS CHINA, 0.125 GPF, WITH SLOAN OPTIMA EXPOSED SENSOR OPERATED ROYAL MODEL 186-0.125 ES-S TMO URINAL FLUSHOMETER VALVE WITH 120V/24 VAC TRANSFORMER (HARD WIRED). WALL HUNG WITH STAINLESS STEEL STRAINER, 0.125 GPF, SLOAN AUTOMATIC FLUSH (HARD WIRED) WITH MANUAL OVERRIDE. ACCESSIBLE.
L-1	LAVATORY	1 1/4" x 1 1/2"	2"	1 1/2"	3/4"	3/4"	KHOLER K-2608-SU "BACHATA", OVAL STAINLESS STEEL UNDER COUNTER, FAUCET: SLOAN OPTIMA EBF-615, WITH 120V/24 VAC TRANSFORMER (HARD WIRED) SENSOR OPERATED, 0.5 GPM AUTOMATIC WATER FLOW SHUT-OFF SET @ 10 SECONDS. GRID DRAIN CHICAGO #327-XCP, CHROME PLATED 'P' TRAP WITH 1-1/2" ESCUTCHEON TUBE. SUPPLY: QUARTER TURN BALL STOPS (IPS THREADED) AND STAINLESS STEEL BRAIDED PVC FLEXIBLE SUPPLIES WITH METAL NUTS.
L-2	LAVATORY (ACCESSIBLE)	1 1/4" x 1 1/2"	2"	1 1/2"	3/4"	3/4"	KHOLER K-2608-SU "BACHATA", OVAL STAINLESS STEEL UNDER COUNTER, FAUCET: SLOAN OPTIMA EBF-615, WITH 120V/24 VAC TRANSFORMER (HARD WIRED) SENSOR OPERATED, 0.5 GPM AUTOMATIC WATER FLOW SHUT-OFF SET @ 10 SECONDS. GRID DRAIN CHICAGO #327-XCP, CHROME PLATED 'P' TRAP WITH 1-1/2" ESCUTCHEON TUBE. SUPPLY: QUARTER TURN BALL STOPS (IPS THREADED) AND STAINLESS STEEL BRAIDED PVC FLEXIBLE SUPPLIES WITH METAL NUTS. ACCESSIBLE.
L-3	LAVATORY (ACCESSIBLE)	1 1/4" x 1 1/2"	2"	1 1/2"	3/4"	3/4"	AMERICAN STANDARD 0356.421 "LUCERNE" VITREOUS CHINA, WALL HUNG, FRONT OVERFLOW, SINGLE CENTER FAUCET HOLE & SPLASH SHIELD. FAUCET: SLOAN OPTIMA EBF-615, WITH 120V/24 VAC TRANSFORMER (HARD WIRED) SENSOR OPERATED, 0.5 GPM AUTOMATIC WATER FLOW SHUT-OFF SET @ 10 SECONDS. GRID DRAIN CHICAGO #327-XCP, CHROME PLATED 'P' TRAP WITH 1-1/2" ESCUTCHEON TUBE. SUPPLY: QUARTER TURN BALL STOPS (IPS THREADED) AND STAINLESS STEEL BRAIDED PVC FLEXIBLE SUPPLIES WITH METAL NUTS. ACCESSIBLE.
S-1	SINK (ACCESSIBLE)	1 1/2" x 1 1/2"	2"	2"	3/4"	3/4"	STAINLESS STEEL, UNDER MOUNT, SINGLE COMPARTMENT (6 1/2" DEEP) WITH DISHWASHER AIR GAP FITTING, 1/2 HP GARBAGE DISPOSAL (INSINKERATOR BADGER 5, 1/2 HP, 120V, 1 PH). PROVIDE WATER FILTER BELOW SINK FOR ICE MAKER, HALSEY TAYLOR 15242 WITH WALL BRACKET. DRAIN OUTLET SHALL BE PROVIDED AT THE CENTER REAR OF THE SINK BOWL. 0.5 GPM MAX. FLOW RATE, CHICAGO FAUCET # 786-GN8AE65VPABCP ELKAY #GOOSENECK WITH BLADE HANDLES. ELKAY ELUHAD211555 (23 1/2" X 18 1/4" X 5 3/8" DEEP). ACCESSIBLE.
S-2	SINK (ACCESSIBLE)	1 1/2" x 1 1/2"	2"	2"	3/4"	3/4"	STAINLESS STEEL, UNDER MOUNT, TWO COMPARTMENT, 6 1/2" DEEP. DRAIN OUTLET SHALL BE PROVIDED AT THE CENTER REAR OF THE SINK BOWL. 0.5 GPM MAX. FLOW RATE, CHICAGO FAUCET # 786-GN8AE65VPABCP ELKAY #GOOSENECK WITH BLADE HANDLES. ELKAY LRAD 2022 (22" x 19-1/2" x 6-1/2" DEEP). ACCESSIBLE.
S-3	SINK (ACCESSIBLE)	1 1/2" x 1 1/2"	2"	2"	3/4"	3/4"	STAINLESS STEEL, UNDER MOUNT, SINGLE COMPARTMENT (6 1/2" DEEP). DRAIN OUTLET SHALL BE PROVIDED AT THE CENTER REAR OF THE SINK BOWL. 0.5 GPM MAX. FLOW RATE, CHICAGO FAUCET # 786-GN8AE65VPABCP ELKAY #GOOSENECK WITH BLADE HANDLES. ELKAY ELUHAD211555 (23 1/2" X 18 1/4" X 5 3/8" DEEP). ACCESSIBLE.
SS-1	SERVICE SINK	3"	3"	2"	3/4"	3/4"	AMERICAN STANDARD 7741.000 "FLOORWELL" ENAMELED CAST IRON, FLOOR MOUNTED, CORNER TYPE. FAUCET: AMERICAN STANDARD 897-RCF, WITH VACUUM BREAKER.
SS-2	SERVICE SINK	3"	3"	2"	3/4"	3/4"	AMERICAN STANDARD 7695.000 "AKRON" ENAMELED CAST IRON, WALL MOUNTED TYPE. FAUCET: AMERICAN STANDARD 897-RCF WITH VACUUM BREAKER. SUPPLY: QUARTER TURN BALL STOPS (IPS THREADED) AND STAINLESS STEEL BRAIDED PVC FLEXIBLE SUPPLIES WITH METAL NUTS.
EEWS-1	EMERGENCY EYEWASH & SHOWER (ACCESSIBLE)	–	–	–	–	1 1/2" TW	BRADLEY S19314DCBF, ACCESSIBLE
EWC-1	DRINKING FOUNTAIN (ACCESSIBLE)	1 1/4"	2"	2"	3/4"	–	HI/LOW, WALL MOUNTED. ACCESSIBLE WITH FILTER AND BOTTLE FILLER, ELKAY EZWS-EDFP217K, 120 V, 1 PH
FD-1	FLOOR DRAIN	2"	2"	2"	1/2"	–	2" DRAIN WITH ROUND GRATE & TRAP PRIMER CONNECTION, ZURN Z415B
FD-2	LAB FLOOR DRAIN	3"	3"	2"	1/2"	–	3" DRAIN WITH ROUND GRATE & TRAP PRIMER CONNECTION, ZURN Z415B
FD-3	GREENHOUSE FLOOR DRAIN	4"	4"	2"	1/2"	–	4" DRAIN WITH SEDIMENT BUCKET (JR SMITH 2210) & TRAP PRIMER CONNECTION
FS-1	FLOOR SINK	2" / 4"	2" / 4"	2"	1/2"	–	HALF GRATE WITH TRAP PRIMER CONNECTION EXTRA DEEP, ZURN 1902.
RR-1	ROOF RECEPTOR	3" / 4"	3" / 4"	2"	–	–	ROUND CAST IRON BODY WITH DOME BOTTOM STRAINER, UNDERDECK CLAMP, 2" HIGH WATER DAM. NO TRAP PRIMER CONNECTION. INSULATE TRAP AND 20' PIPING FOR ROOF RECEPTOR SERVING ROOF AHU CONDENSATE. ZURN Z122.
RD-1	ROOF DRAIN	–	AS NOTED	–	–	–	ZURN Z100
RD-2	ROOF DRAIN	–	AS NOTED	–	–	–	J.R. SMITH 1620T (1)
OD-1	OVERFLOW ROOF DRAIN	–	AS NOTED	–	–	–	ZURN Z100
ODS-1	OVERFLOW DRAIN SPOUT	–	AS NOTED	–	–	–	PROVIDE J.R. SMITH MODEL 1770 WITH CAST BRONZE BODY AND FLANGE AND NICKEL BRONZE FINISH
AD-1	AREA DRAIN	–	–	–	–	–	CONNECTION TO STORM DRAIN SYSTEM, HEEL PROOF GRATING, ZURN Z125
TP-1	TRAP PRIMER	–	–	–	1/2"	–	PROVIDE SOV & ACCESS DOOR. TRAP PRIMER TO ALL FLOOR DRAIN AND FLOOR SINK IN TOILET ROOMS, MIFAB M-500
TP-2	ELECTRONIC TRAP PRIMER	–	–	–	1/2"	–	PROVIDE SOV & ACCESS DOOR. 120V-1PH-60Hz. TRAP PRIMER TO ALL FLOOR DRAIN AND FLOOR SINK AWAY FROM TOILETS. MIFAB MI-300
HB-1	HOSE BIBB	–	–	–	3/4"	–	PROVIDE SOV TO WALL MOUNTED RECESSED WOODFORD MODEL B75 WITH 3/4" FEMALE INLET WITH VACUUM BREAKER
HB-2	HOSE BIBB	–	–	–	3/4"	–	PROVIDE SOV TO EXPOSED WOODFORD MODEL Y24 WITH 3/4" FEMALE INLET WITH VACUUM BREAKER

PLUMBING FIXTURE SCHEDULE NOTES:
1. COVER HOT WATER SUPPLY & TRAP WITH ONE-PIECE INSULATION.
2. PROVIDE TRAP PRIMERS WITH SOV FOR ALL FLOOR DRAINS & FLOOR SINKS IN BUILDING WITH ACCESS PANEL.
3. SENSOR FAUCETS & FLUSHING DEVICES TO BE PROVIDED WITH TRANSFORMERS.
4. PROVIDE ANGLE STOPS TO EACH LAVATORY, SINK, LAB SINK, FUMEHOOD.
5. EACH URINAL GROUP SHALL BE PROVIDED WITH CLEANOUT.
6. EACH SINK, LAVATORY FIXTURE AND WATER CLOSET GROUP SHALL BE PROVIDED WITH CLEANOUT.
7. ACCESS PANELS FOR SENSOR FAUCET TRANSFORMERS SHALL BE BELOW LAVATORY FIXTURE.
8. ACCESS PANELS FOR SENSOR FLUSH VALVE TRANSFORMERS SHALL BE ABOVE FIXTURE.
9. AT S-1, S-2, S-3 CONDITIONS, PROVIDE NOTCH IN COUNTERTOP OPENING TO ENSURE THAT TOP LIP OF SINK BASIN IS MAX 1/2 INCH BELOW TOP OF COUNTER ELEVATION.

PIPE MATERIAL SCHEDULE

PLUMBING SERVICE		MATERIAL: COPPER TYPE 'L', ASTM B88, B32 FITTINGS, ASME B16.18, B16.22, B16.24	COPPER TYPE "L" (SOLDERED)	COPPER TYPE 'K', ASTM B88, B32 FITTINGS, ASME B16.18, B16.22, B16.24	HUBLESS, CAST IRON SOIL PIPE CISPI HUBLESS COUPLINGS WITH NFS CERTIFICATION	HUBLESS, CAST IRON SOIL PIPE, ASTM C564 HEAVY DUTY, SHEILDED STAINLESS STEEL COUPLING	SCHEDULE 40 BLACK STEEL PIPE & FITTINGS, ASTM A 53	POLYETHYLENE PIPE AND FITTING WITH HEAT FUSION JOINT, SDR11 PE 2406	POLYPROPYLENE	REMARKS
SANITARY WASTE	ABOVE GRADE				●					
	BELOW GRADE					●				PROVIDE CORROSION PROTECTION PER ASTM A674 OR AWWA C105
SANITARY VENT, STORM DRAIN VENT	ABOVE GRADE				●					
	BELOW GRADE					●				PROVIDE CORROSION PROTECTION PER ASTM A674 OR AWWA C105
LABORATORY WASTE & VENT	ABOVE GRADE								●	PROVIDE PVDF FOR MECHANICAL PLENUM AREAS
	BELOW GRADE								●	PROVIDE PVDF FOR MECHANICAL PLENUM AREAS
STORM DRAIN	ABOVE GRADE				●					
	BELOW GRADE					●				PROVIDE CORROSION PROTECTION PER ASTM A674 OR AWWA C105
CONDENSATE & INDIRECT DRAIN	ABOVE GRADE		●							
DOMESTIC COLD & HOT, INDUSTRIAL WATER	ABOVE GRADE	●								
	BELOW GRADE			●						PROVIDE CORROSION PROTECTION PER ASTM A674 OR AWWA C105
VACUUM SYSTEM	ABOVE GRADE			●						
COMPRESSED AIR	ABOVE GRADE			●						
NATURAL GAS	ABOVE GRADE						●			EXPOSED PIPING ABOVE GROUND TO BE PAINTED WITH RUSTPROOF COATING.
	BELOW GRADE							●		WITH ROHS COMPLIANT TRACKER WIRE.
PURE WATER SYSTEM	ABOVE GRADE								●	PROVIDE PVDF FOR MECHANICAL PLENUM AREAS

AIR COMPRESSOR & VACUUM PUMP SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	CAPACITY: STD AIR (SCFM)	AIR DISCHARGE (PSI)	VAC. INLET (IN. Hg)	SYSTEM MAX. PRESS DROP	AIR RECEIVER (GALLON)	MOTOR CAPACITY (EACH): HP	VOLTS	PH	HZ	OPER. WT.(LBS)	BAS INTERPHASE	ANCHORAGE DETAIL NUMBER	REMARKS
CA 1	LEVEL 1 PLUMBING ROOM	LAB COMPRESSED AIR	BEACON MEDAES LAS10H-240V-HCDY-SPL	115	110	–	4 PSI	200	10 x 6	460	3	60	5000	MONITOR MODULE	6 / P5.05	OILESS SCROLL, AIR COOLED, COMPLETE WITH AIR DRYERS BOLT UNIT TO EQUIPMENT PAD INCLUDING 6TH PUMP FOR BACK-UP. WITH BACNET OUTPUT FOR BMS CONNECTION. PROVIDE INTAKE MANIFOLD TO ROOF INTAKE CONNECTION.
VP 1	LEVEL 1 PLUMBING ROOM	LAB VACUUM	BEACON MEDAES LVLS20T-200V-QC	248	–	20" Hg	4" Hg	200	20 x 3 (TRIPLEX)	460	3	60	7000	MONITOR MODULE	6 / P5.01	OILESS LIQUID RING BOLT UNIT TO EQUIPMENT PAD. WITH BACNET OUTPUT FOR BMS CONNECTION. PROVIDE EXHAUST MANIFOLD TO ROOF EXHAUST CONNECTION.

PUMP SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	CAPACITY: FLOW (GPM)	TOTAL HEAD (FT)	MOTOR CAPACITY: HP	RPM	VOLTS	PH	HZ	OPER. WT.(LBS)	ANCHORAGE DETAIL NUMBER	REMARKS
CRP 1&2	LEVEL 1 PLUMBING ROOM	GWH-1 CIRCULATING PUMP DOMESTIC	ARMSTRONG E.2 SERIES	10	30	1/2	1725	120	1	60	80	–	WITH BACNET OUTPUT FOR BMS CONNECTION.
CRP 3&4	LEVEL 1 PLUMBING ROOM	GWH-2 CIRCULATING PUMP INDUSTRIAL	ARMSTRONG E.2 SERIES	10	30	1/2	1750	120	1	60	80	–	WITH BACNET OUTPUT FOR BMS CONNECTION.
CDP 1	AS INDICATED ON FLOOR PLANS	MECHANICAL CONDENSATE	LITTLE GIANT VCL-24ULS	3	9	1/5	1750	120	1	60	10	–	USE HARTELL A2X-1965, HARD WIRED & UL LISTED FOR PLENUM APPLICATION
BP 1	LEVEL 1 PLUMBING ROOM	PACKAGE BOOSTER PUMP SYSTEM	GRUNDFOS BOOSTERPAQ HYDRO MPCE CRE 15-3-WA	240	90	3 X 5	3450	460	3	60	1300	3 / P5.04	CLOSED COUPLED END SUCTION PACKAGED TRIPLEX PUMP WITH HYDROPNEUMATIC TANK. PROVIDE VARIABLE FREQUENCY DRIVE CONTROLLER. WITH BACNET OUTPUT FOR BMS CONNECTION.

TANK SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	TYPE	TANK VOLUME (GAL.)	TANK SIZE (IN.)	OPER. WT.(LBS)	ANCHORAGE DETAIL NUMBER	REMARKS
ET 1	LEVEL 1 PLUMBING ROOM	GWH-1 EXPANSION TANK DOMESTIC	AMTROL ST-30V-C	PRE-CHARGED STEEL	14	24"HI x 15" DIA.	150	1 / P5.04	ASME TANK
ET 2	LEVEL 1 PLUMBING ROOM	GWH-2 EXPANSION TANK INDUSTRIAL	AMTROL ST-30V-C	PRE-CHARGED STEEL	14	24"HI x 15" DIA	150	2 / P5.04	ASME TANK
ST 1	LEVEL 1 PLUMBING ROOM	GWH-1 STORAGE TANK DOMESTIC	BRADFORD WHITE NH210NE5A	HORIZONTAL	210	75" LONG x 30" DIA.	2200	1 / P5.04	ASME TANK, INSULATE TANK
ST 2	LEVEL 1 PLUMBING ROOM	GWH-2 STORAGE TANK INDUSTRIAL	BRADFORD WHITE NH210NE5A	HORIZONTAL	210	75" LONG x 30" DIA.	2200	2 / P5.04	ASME TANK, INSULATE TANK
SB 1	OUTDOORS (UNDERGROUND)	CONCRETE SAMPLING BOX	JENSEN MODEL 200 OR EQUAL PRE-CAST CONCRETE	CONCRETE	200	36" DIAMETER x H "H" AS INDICATED ON DETAIL	–	–	SAMPLE BOX W/ PH PROBE & MONITOR/RECORDER (15 AMP CIRCUIT) AT PLUMBING ROOM

GAS WATER HEATER SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	BTU INPUT	RECOVERY AT 100°F Δ	WATER TEMP °F: IN	OUT	OPER. WT.(LBS)	ANCHORAGE DETAIL NUMBER	REMARKS
GWH 1	LEVEL 1 PLUMBING ROOM	DOMESTIC HOT WATER	RAYPAK MVB 504A	500,000	509	40	140	600	1 / P5.04	120 VOLTS, 1 PHASE LOW NOX WITH VERSA IC INTEGRATED CONTROLLER, WITH BACNET OUTPUT FOR BMS CONNECTION, WITH NEUTRALIZATION KIT.
GWH 2	LEVEL 1 PLUMBING ROOM	INDUSTRIAL HOT WATER	RAYPAK MVB 504A	500,000	509	40	140	600	2 / P5.04	120 VOLTS, 1 PHASE LOW NOX WITH VERSA IC INTEGRATED CONTROLLER, WITH BACNET OUTPUT FOR BMS CONNECTION, WITH NEUTRALIZATION KIT.

THERMOSTATIC MIXING VALVE SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	SIZE	RATING: GPM	PSI DROP	REMARKS
TMV 1	LEVEL 1 PLUMBING ROOM	DOMESTIC HOT WATER SYSTEM	BRADLEY S59-3080	2"	36	10	DIAL THERMOMETER & SHUT-OFF VALVE. OUTLET TEMPERATURE SET AT 120°F HIGH / LOW FLOW MIXING VALVE. AB 1953 COMPLIANT.
TMV 2	LEVEL 1 PLUMBING ROOM	INDUSTRIAL HOT WATER SYSTEM	BRADLEY S59-3200	2 1/2"	91	10	DIAL THERMOMETER & SHUT-OFF VALVE. OUTLET TEMPERATURE SET AT 120°F HIGH / LOW FLOW MIXING VALVE. AB 1953 COMPLIANT.
TMV 3	LEVEL 1 PLUMBING ROOM	TEMPERED WATER SYSTEM	LAWLER #911	1 1/2"	35	10	DIAL THERMOMETER & SHUT-OFF VALVE. OUTLET TEMPERATURE SET AT 75°F WITH STAINLESS STEEL SURFACE MOUNTED CABINET C/W MOUNTING BRACKET.

BACKFLOW PREVENTER SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	TYPE	SIZE	FLOW (GPM)	OPER. WT.(LBS)	REMARKS
RPBP 1	LEVEL 1 PLUMBING ROOM	MAIN WATER SERVICE	WILKINS MODEL 375	REDUCED PRESSURE TYPE	4"	240	200	RUN 3/4" FROM RELIEF VALVE TO FLOOR SINK. REFER TO CIVIL DRAWING FOR LOCATION.
RPBP 2	LEVEL 1 PLUMBING ROOM	INDUSTRIAL WATER SUPPLY	WILKINS MODEL 375	REDUCED PRESSURE TYPE	3"	120	170	RUN 3/4" FROM RELIEF VALVE TO FLOOR SINK
RPBP 3	GREENHOUSE	INDUSTRIAL WATER SUPPLY	WILKINS MODEL 375	REDUCED PRESSURE TYPE	1-1/2"	75	170	RPBP WITH BALL VALVE OPTION, RUN 3/4" FROM RELIEF VALVE TO FLOOR SINK

LABORATORY REVERSE OSMOSIS - DEIONIZED WATER EQUIPMENT SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	QUANTITY	DESCRIPTION	ANCHORAGE DETAIL NUMBER	REMARKS
RO/DI 1	LEVEL 1 PLUMBING ROOM	LABORATORIES	WATERWORKS REFER TO P4.09 FOR EQUIPMENT P&ID	1	WATERWORKS ES-2 RO/DI SKID WITH 1,000 GPD LOW ENERGY RO, 15 GPM, 1-1/2" PP DISTRIBUTION, HIGH EFFICIENCY UV, 0.2 MICRON FINAL FILTRATION, 3 HP VERTICAL MULTISTAGE 316 SS DISTRIBUTION PUMP, SANITARY TRI-CLAMP CONNECTIONS FROM UV DOWNSTREAM.	8 / P5.04	DI STORAGE TANK IS TO HAVE A SEPARATE VENT WITH FILTER. THE OVERFLOW LINE SHALL NOT BE USED FOR VENTING. CONTROL PANEL WITH BACNET OUTPUT FOR BMS CONNECTION.
				1	WATER WORKS 2900 DUPLEX, 15 CUBIC FT SOFTENER SYSTEM WITH ELECTRONIC CONTROLS, 2"IN/OUT, 105 GPM, 110V, 60HZ	4 / P5.04	
				2	WATER WORKS 3.6P-MBDI MIXED BED SERVICE DI TANKS.	8 / P5.04	
				1	WATER WORKS 1,000 GALLON PE CONE BOTTOM TANK WITH SEISMIC ZONE 4 RESTRAINT SYSTEM, NON-VENTED MANWAY, 0.2 MICRON HYDROPHOBIC VENT FILTER AND PROGRAMMABLE ULTRASONIC LEVEL CONTROL. 66" DIAMETER x 111" TALL.	9 / P5.04	
DI 2	GREENHOUSE SC001	GREENHOUSE	WATERWORKS REFER TO P4.10 FOR EQUIPMENT P&ID	1	5 GPM DI SYSTEM WITH 3.6 CUBIC FT CARBON BED TANK, (2) 3.6 CUBIC FT MIXED BED TANKS, 1 MICRON MAKE-UP FILTER, 3.6 CUBIC FT POLISHING MIXED BED TANK, UV DISINFECTING EQUIPMENT, 0.20 MICRON FINAL FILTER, ROTOMETER, DISTRIBUTION 1/2 HP PUMP AND CONTROLS, 110V, 60 HZ.	10 / P5.04	

METER SCHEDULE

MARK	DESCRIPTION	READING	MANUFACTURER & MODEL NO.	CONNECTION SIZE	REMARKS
WM 1	LAB BUILDING DOMESTIC WATER SUB-METER	GALLONS CUBIC FEET	INVENSYS METERING SYSYTEMS (SENSUS) MODEL 4" OMNI C2 COMPOUND METER CONFORMING TO AWWA C702 WITH A BRONZE CASE HOUSING	4" CLASS 150 FLANGES	1. METERS WITH BOTH A VISUAL REGISTER AND PULSE OUTPUT SENSOR FOR AUTOMATIC METER READING. 2. PROVIDE BACNET OUTPUT FOR BMS CONNECTION. 3. PROVIDE SHUT-OFF VALVE BEFORE & AFTER METER. PROVIDE NECESSARY CLEARANCES AND INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
WM 2	GREENHOUSE BUILDING DOMESTIC WATER SUB-METER	GALLONS CUBIC FEET	INVENSYS METERING SYSYTEMS (SENSUS) MODEL 1-1/2" OMNI C2 COMPOUND METER CONFORMING TO AWWA C702 WITH A BRONZE CASE HOUSING	1-1/2" CLASS 150 WITH UNIONS	
GM 1	LAB BUILDING SUB-METER	CUBIC FEET	ROTARY TYPE SUB METER DRESSER ROOTS SERIES B MODEL "5M175 METER" WITH PULSER, E METER BY ITRON SENTINEL R300 COMPLETE WITH KYZ PULSE INPUT & SERIAL OUTPUT	6" CLASS 150 WITH UNIONS	

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LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER JOHN GAUTREY No. M-29791 Exp.06-30-2018 MECHANICAL STATE OF CALIFORNIA

NAME: JOHN GAUTREY
DATE: DECEMBER 16, 2016
REGISTRATION NUMBER: M-29791

△NO	DESCRIPTION	DATE
1	ADDENDUM 1	08/22/17
3	ADDENDUM 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: | REVIEW BY: JG

HGA NO: 3584-001-00

PLUMBING SCHEDULES

DATE: JULY 06, 2017

P0.02

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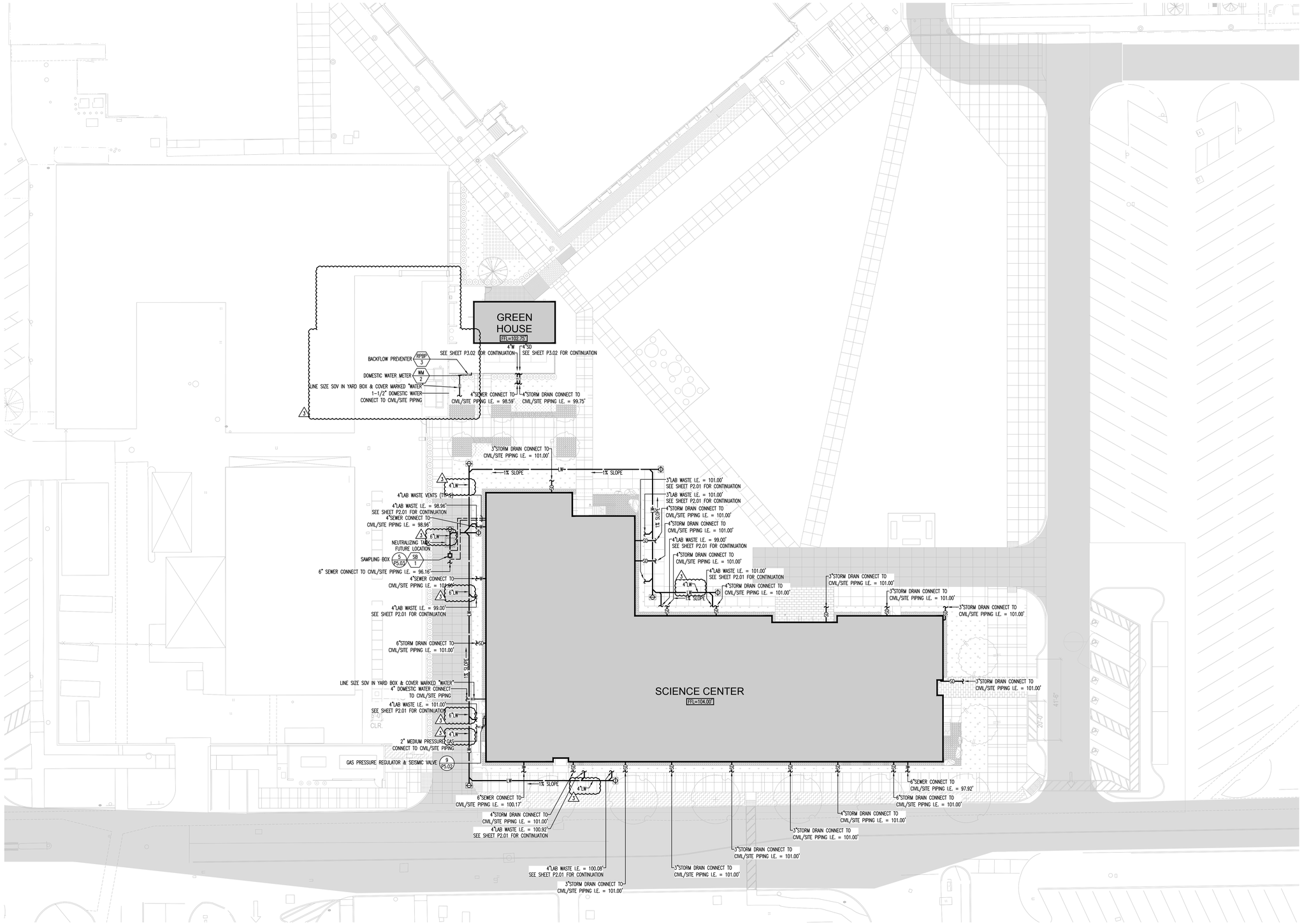
Plotted By: YADAO, TENG



1 SITE PLAN CIVIL COORDINATION
1" = 20'-0"

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NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/17

ISSUANCE HISTORY - THIS SHEET

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HGA NO: 3584-001-00

PLUMBING SITE PLAN

DATE: JULY 06, 2017

P1.11

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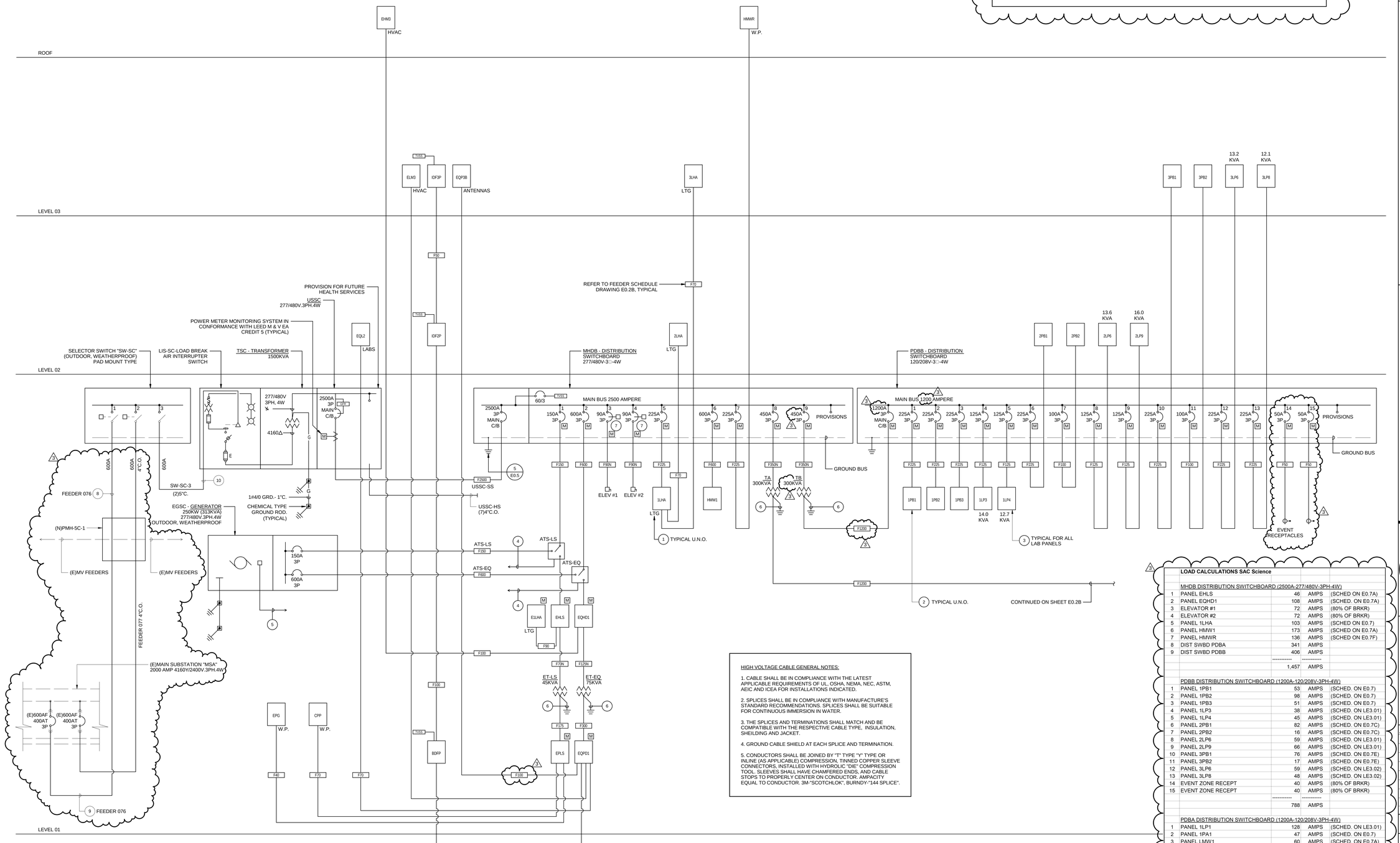
Drawing Name: \\us1313-f01\workgroup\2045\active\204511650\drawing\plumbing\p1.11.dwg
Plot Date: Thursday, September 21, 2017 1:57:46 PM
Plotted By: CRUZ, RICHARD

PERFORMANCE NOTE

1. REFER TO LAB SERIES DRAWINGS FOR ALL LAB PANELBOARDS. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL PANELBOARDS INDICATED ON THE ELECTRICAL LABORATORY ELECTRICAL DRAWINGS.



UNINTERRUPTIBLE POWER SUPPLY "UPS"

UPS INPUT VOLTAGE: 208V, 3 PHASE, 3 WIRE
UPS OUTPUT VOLTAGE: 208/120V, 3 PHASE, 4 WIRE

UPS FULL RATED LOAD CONTINUOUS

24 KW @ 1.0 POWER FACTOR
30 KW @ 0.8 POWER FACTOR

FULL RATED LOAD
RUNNING TIME ON BATTERY CAPACITY
NOT LESS THAN 20 MINUTES CONTINUOUS

+25% SPARE CAPACITY

HIGH VOLTAGE CABLE GENERAL NOTES:

1. CABLE SHALL BE IN COMPLIANCE WITH THE LATEST APPLICABLE REQUIREMENTS OF UL, OSHA, NEMA, NEC, ASTM, AEIC AND ICEA FOR INSTALLATIONS INDICATED.

2. SPLICES SHALL BE IN COMPLIANCE WITH MANUFACTURE'S STANDARD RECOMMENDATIONS. SPLICES SHALL BE SUITABLE FOR CONTINUOUS IMMERSION IN WATER.

3. THE SPLICES AND TERMINATIONS SHALL MATCH AND BE COMPATIBLE WITH THE RESPECTIVE CABLE TYPE, INSULATION, SHEILDING AND JACKET.

4. GROUND CABLE SHIELD AT EACH SPLICE AND TERMINATION.

5. CONDUCTORS SHALL BE JOINED BY "T" TYPE "Y" TYPE OR INLINE (AS APPLICABLE) COMPRESSION, TINNED COPPER SLEEVE CONNECTORS, INSTALLED WITH HYDROLIC "DIE" COMPRESSION TOOL. SLEEVES SHALL HAVE CHAMFERED ENDS, AND CABLE STOPS TO PROPERLY CENTER ON CONDUCTOR. AMPACITY EQUAL TO CONDUCTOR. 3M-"SCOTCHLOK", BURNDY-"144 SPLICE".

NOTE:
REFER TO SINGLE LINE DIAGRAM PLAN NOTES ON DRAWING E0.2B.

LOAD CALCULATIONS SAC Science

	MHDB DISTRIBUTION SWITCHBOARD (2500A-277/480V-3PH-4W)			
1	PANEL EHLS	46	AMPS	(SCHED ON E0.7A)
2	PANEL EQHD1	108	AMPS	(SCHED. ON E0.7A)
3	ELEVATOR #1	72	AMPS	(80% OF BRKR)
4	ELEVATOR #2	72	AMPS	(80% OF BRKR)
5	PANEL 1LHA	103	AMPS	(SCHED ON E0.7)
6	PANEL HMW1	173	AMPS	(SCHED ON E0.7A)
7	PANEL HMWR	136	AMPS	(SCHED ON E0.7F)
8	DIST SWBD PDBA	341	AMPS	
9	DIST SWBD PDBB	406	AMPS	
		1,457	AMPS	
	PDBB DISTRIBUTION SWITCHBOARD (1200A-120/208V-3PH-4W)			
1	PANEL 1PB1	53	AMPS	(SCHED. ON E0.7)
2	PANEL 1PB2	98	AMPS	(SCHED. ON E0.7)
3	PANEL 1PB3	51	AMPS	(SCHED. ON E0.7)
4	PANEL 1LP3	38	AMPS	(SCHED. ON LE3.01)
5	PANEL 1LP4	45	AMPS	(SCHED. ON LE3.01)
6	PANEL 2PB1	82	AMPS	(SCHED. ON E0.7C)
7	PANEL 2PB2	16	AMPS	(SCHED. ON E0.7C)
8	PANEL 2LP6	59	AMPS	(SCHED. ON LE3.01)
9	PANEL 2LP9	66	AMPS	(SCHED. ON LE3.01)
10	PANEL 3PB1	76	AMPS	(SCHED. ON E0.7E)
11	PANEL 3PB2	17	AMPS	(SCHED. ON E0.7E)
12	PANEL 3LP6	59	AMPS	(SCHED. ON LE3.02)
13	PANEL 3LP8	48	AMPS	(SCHED. ON LE3.02)
14	EVENT ZONE RECEPT	40	AMPS	(80% OF BRKR)
15	EVENT ZONE RECEPT	40	AMPS	(80% OF BRKR)
		788	AMPS	
	PDBA DISTRIBUTION SWITCHBOARD (1200A-120/208V-3PH-4W)			
1	PANEL 1LP1	128	AMPS	(SCHED. ON LE3.01)
2	PANEL 1PA1	47	AMPS	(SCHED. ON E0.7)
3	PANEL LMW1	60	AMPS	(SCHED. ON E0.7A)
4	PANEL 2PA1	14	AMPS	(SCHED. ON E0.7C)
5	PANEL 3PA1	14	AMPS	(SCHED. ON E0.7E)
6	PANEL 2LP1	59	AMPS	(SCHED. ON LE3.01)
7	PANEL 2LP2	25	AMPS	(SCHED. ON LE3.01)
8	PANEL 2LP3	49	AMPS	(SCHED. ON LE3.01)
9	PANEL 2LP4	47	AMPS	(SCHED. ON LE3.01)
10	PANEL 2LP5	22	AMPS	(SCHED. ON LE3.01)
12	PANEL 2LP7	80	AMPS	(SCHED. ON LE3.01)
13	PANEL 2LP8	43	AMPS	(SCHED. ON LE3.01)
15	PANEL 3LP1	59	AMPS	(SCHED. ON LE3.01)
16	PANEL 3LP2	49	AMPS	(SCHED. ON LE3.02)
17	PANEL 3LP3	78	AMPS	(SCHED. ON LE3.02)
18	PANEL 3LP4	57	AMPS	(SCHED. ON LE3.02)
19	PANEL 3LP5	30	AMPS	(SCHED. ON LE3.02)
21	PANEL 3LP7	67	AMPS	(SCHED. ON LE3.02)
23	PANEL LMWR	10	AMPS	(SCHED. ON E0.7F)
		938	AMPS	

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

SINGLE LINE DIAGRAM

DATE: JULY 06, 2017

E0.2A

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FBA

SINGLE LINE DIAGRAM GENERAL NOTES:

1. ALL FEEDER LENGTHS INDICATED ON THE SINGLE LINE DIAGRAM ARE ONLY FOR CALCULATION PURPOSES AND NOT FOR TAKE-OFF.

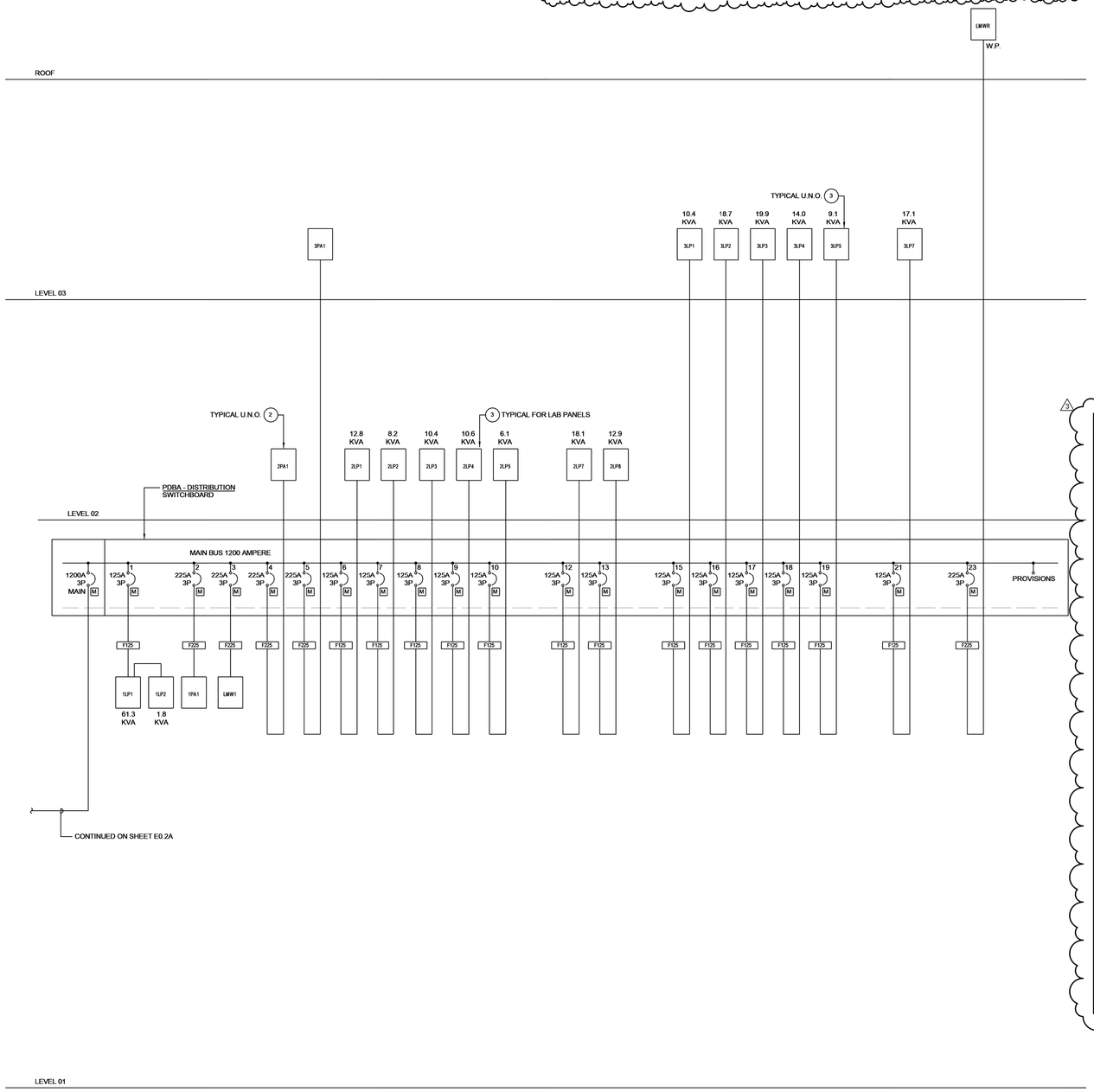
2. THE GROUNDING ELECTRODE, CONDUCTOR SIZE, AND THE NEUTRAL BOND AT THE GENERATOR AND SWITCHBOARD BOTH REQUIRE SIGNS INSTALLED AT THE SERVICE.

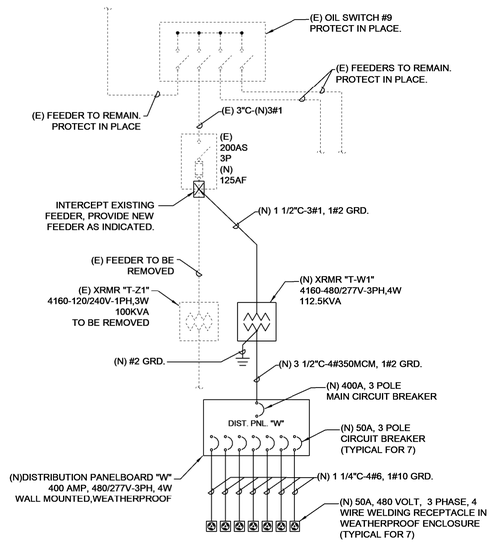
3. UNLESS NOTED OTHERWISE, ALL 480/277V PANELS SHALL BE RATED FOR MINIMUM 14,000 AMP. AIC.

4. UNLESS NOTED OTHERWISE, ALL 208/120V PANELS SHALL BE RATED FOR MINIMUM 10,000 AMP. AIC.

SINGLE LINE DIAGRAM PLAN NOTES:

1. 225 AMPERE - 277/480V,3PH.4W, 42 CIRCUIT, U.N.O.
2. 225 AMPERE - 120/208V,3PH.4W, 42 CIRCUIT, U.N.O.
3. 225 AMPERE - 120/208V,3PH.4W ELECTRONIC GRADE PANELBOARD WITH MAIN CIRCUIT BREAKER, INTERNAL TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS), EQUIPMENT GROUND AND ISOLATED GROUND BUS.
4. PROVIDE CONDUIT AND WIRE CONNECTIONS FOR ATS CONTROLS AND INTERLOCKS:
   a. 1"C. - 6#14 TO ENGINE GENERATOR ANNUNCIATOR PANEL.
5. PROVIDE CONDUIT & WIRE CONNECTIONS FOR ENGINE GENERATOR CONTROLS, AUXILIARY AND CONTROL POWER:
   a. 1"C.-5#10 TO RESPECTIVE AUTOMATIC TRANSFER SWITCH FOR ENGINE "STOP/START" CONTROL AND AUTOMATIC ENGINE EXERCISER CONTROL.
   b. 1 1/2"C.-16#14 TO ENGINE GENERATOR ANNUNCIATOR PANEL.
   c. 1"C. W/ (3)#6 AND (1)#8 GROUND FOR GENERATOR SUBPANEL. SEE SHEETS E0.05 AND E0.14.
6. SEE TRANSFORMER SCHEDULE, SHEET E0.2A, FOR GROUNDING REQUIREMENTS.
7. 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.
8. PROVIDE (3) #500 KCMIL, 5KV, 115 MIL/133%, EPR, MV-105 UL CLASS & TEMP RATING, T5 SHIELDING, COPPER, (1) #1/0 GRD. - (N) 4"C.
9. PROVIDE (3) #500 KCMIL, 5KV, 115 MIL/133%, EPR, MV-105 UL CLASS & TEMP RATING, T5 SHIELDING, COPPER, (1) #1/0 GRD. - (E) 4"C.
10. PROVIDE (3) #500 KCMIL, 5KV, 115 MIL/133%, EPR, MV-105 UL CLASS & TEMP RATING, T5 SHIELDING, COPPER, (1) #1/0 GRD. - (N) 5"C. AND (1) 5"C.O. SPARE.





1 SINGLE LINE DIAGRAM - WELDING
NONE

3

FEEDER SCHEDULE

FEEDER TYPE	COPPER CONDUCTORS THW 600V (AWG) CONDUIT AND EQUANTITY		CONDUCTORS IN EACH CONDUIT PHASE/NEUTRAL		EQUIPMENT GROUND WIRE SIZE
	QUAN.	SIZE	QUAN.	SIZE	
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
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
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
F300/N	1	3"	3	350MCM	4
F350/N	1	4"	3	500MCM	2
F400/N	2	2"	3	3/0	2
F500/N	2	2 1/2"	3	250MCM	2
F600/N	2	3"	3	350MCM	1
F700/N	2	4"	3	500MCM	1/0
F800/N	3	3"	3	350MCM	1/0
F300/U	1	4"	4	500MCM	2
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
F1500/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/NU	-	-	-	-	-
F400/NU	2	3"	3	4/0	2
F500/NU	2	4"	3	350MCM	1/0
F600/NU	2	4"	3	500MCM	1/0
F700/NU	2	4"	3	500MCM	1/0
F800/NU	3	4"	3	350MCM	2/0
F100/DN	1	2"	5	1	8
F125/DN	1	2 1/2"	5	1/0	6
F150/DN	1	2 1/2"	5	1/0	4
F175/DN	1	3"	5	2/0	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	4"	5	350MCM	1/0
F1200/DN	4	4"	5	350MCM	3/0
F1600/DN	5	5"	5	500MCM	4/0

3

SHORT CIRCUIT AND VOLTAGE DROP CALCULATIONS

FEEDERS

DESIGNATION	FEEDER LENGTH (ft)	PHASE ϕ	CONDUCTORS Cu	CONDUCTORS SIZE	CONDUCTORS PARALLEL RUNS	CONDUIT MAG=1 NON=2	L-L VOLTAGE	L-N VOLTAGE	STARTING Isc	FEEDER AMPACITY	BUS AVAILABLE Isc 3 ϕ	BUS AVAILABLE Isc - ϕ L-L	BUS AVAILABLE Isc 1 ϕ L-N	VOLTAGE DROP %
SUBSTATION "USSC-SS"	160	3	Cu	500MCM	7	2	480	277	36,887	2500	33,098	N/A	N/A	0.85
FEEDER MHDB-1	100	3	Cu	#1/0	1	1	480	277	33,089	150	14,153	N/A	N/A	0.71
FEEDER ATS-S	30	3	Cu	#1/0	1	1	480	277	14,153	150	12,079	N/A	N/A	0.21
FEEDER MHDB-2	100	3	Cu	350MCM	2	1	480	277	33,089	600	25,395	N/A	N/A	0.61
FEEDER ATS-EQ	40	3	Cu	350MCM	2	1	480	277	25,395	600	23,234	N/A	N/A	0.25
FEEDER EQHD1	10	3	Cu	#1/0	1	1	480	277	23,234	125	21,239	N/A	N/A	0.06
FEEDER MHDB-3	140	3	Cu	#2	1	1	480	277	33,089	90	11,517	N/A	N/A	0.60
FEEDER MHDB-4	140	3	Cu	#2	1	1	480	277	33,089	90	11,517	N/A	N/A	0.60
FEEDER MHDB-5	25	3	Cu	#4/0	1	1	480	277	33,089	225	27,622	N/A	N/A	0.16
FEEDER 1LHA-1	45	3	Cu	#4	1	1	480	277	27,622	70	20,472	N/A	N/A	0.11
FEEDER 1LHA-2	65	3	Cu	#4	1	1	480	277	29,622	70	19,223	N/A	N/A	0.15
FEEDER MHDB-6	50	3	Cu	350MCM	2	1	480	277	33,089	600	28,736	N/A	N/A	0.31
FEEDER MHDB-7	80	3	Cu	#4/0	1	1	480	277	33,089	225	20,259	N/A	N/A	0.51
FEEDER MHDB-8	30	3	Cu	500MCM	1	1	480	277	33,089	350	28,489	N/A	N/A	0.18
FEEDER TA	10	3	Cu	350MCM	4	1	208	120	28,489	1200	27,657	N/A	N/A	0.14
FEEDER MHDB-9	30	3	Cu	500MCM	1	1	480	277	33,089	350	28,489	N/A	N/A	0.18
FEEDER TB	50	3	Cu	350MCM	4	1	208	120	24,489	1200	21,684	N/A	N/A	0.71
FEEDER PDBB-1	150	3	Cu	#4/0	1	1	208	120	21,684	225	7,756	N/A	N/A	2.21
FEEDER PDBB-2	155	3	Cu	#4/0	1	1	208	120	21,684	225	7,593	N/A	N/A	2.28
FEEDER PDBB-3	160	3	Cu	#4/0	1	1	208	120	21,684	225	7,437	N/A	N/A	2.35
FEEDER PDBB-4	110	3	Cu	#1/0	1	1	208	120	21,684	100	6,722	N/A	N/A	1.21
FEEDER PDBB-5	135	3	Cu	#1/0	1	1	208	120	21,684	100	5,811	N/A	N/A	1.48
FEEDER PDBB-6	170	3	Cu	#4/0	1	1	208	120	21,684	225	7,144	N/A	N/A	2.50
FEEDER PDBB-7	175	3	Cu	#1/0	1	1	208	120	21,684	100	4,775	N/A	N/A	1.92
FEEDER PDBB-8	180	3	Cu	#1/0	1	1	208	120	21,684	125	4,671	N/A	N/A	2.47
FEEDER PDBB-9	185	3	Cu	#1/0	1	1	208	120	21,684	125	4,572	N/A	N/A	2.53
FEEDER PDBB-10	190	3	Cu	#4/0	1	1	208	120	21,684	225	6,622	N/A	N/A	2.80
FEEDER PDBB-11	195	3	Cu	#1/0	1	1	208	120	21,684	100	4,385	N/A	N/A	2.14
FEEDER PDBB-12	190	3	Cu	#4/0	1	1	208	120	21,684	225	6,622	N/A	N/A	2.80
FEEDER PDBB-13	200	3	Cu	#4/0	1	1	208	120	21,684	225	6,388	N/A	N/A	2.94
FEEDER PDBA-1	85	3	Cu	#1/0	1	1	208	120	27,657	125	8,660	N/A	N/A	1.16
FEEDER PDBA-2	25	3	Cu	#4/0	1	1	208	120	27,657	225	20,016	N/A	N/A	0.37
FEEDER PDBA-3	170	3	Cu	#4/0	1	1	208	120	27,657	225	7,691	N/A	N/A	2.50
FEEDER PDBA-4	50	3	Cu	#4/0	1	1	208	120	27,657	225	19,683	N/A	N/A	0.74
FEEDER PDBA-5	75	3	Cu	#4/0	1	1	208	120	27,657	225	12,882	N/A	N/A	1.10
FEEDER PDBA-6	150	3	Cu	#1/0	1	1	208	120	27,657	125	5,678	N/A	N/A	2.06
FEEDER PDBA-7	100	3	Cu	#1/0	1	1	208	120	27,657	125	7,724	N/A	N/A	1.37
FEEDER PDBA-8	80	3	Cu	#1/0	1	1	208	120	27,657	125	9,025	N/A	N/A	1.10
FEEDER PDBA-9	100	3	Cu	#1/0	1	1	208	120	27,657	125	7,724	N/A	N/A	1.37
FEEDER PDBA-10	75	3	Cu	#1/0	1	1	208	120	27,657	125	9,421	N/A	N/A	1.03
FEEDER PDBA-12	50	3	Cu	#1/0	1	1	208	120	27,657	125	12,075	N/A	N/A	0.69
FEEDER PDBA-13	80	3	Cu	#1/0	1	1	208	120	27,657	125	9,025	N/A	N/A	1.10
FEEDER PDBA-15	170	3	Cu	#1/0	1	1	208	120	27,657	125	5,134	N/A	N/A	2.33
FEEDER PDBA-16	125	3	Cu	#1/0	1	1	208	120	27,657	125	6,545	N/A	N/A	1.71
FEEDER PDBA-17	110	3	Cu	#1/0	1	1	208	120	27,657	125	7,205	N/A	N/A	1.51
FEEDER PDBA-18	125	3	Cu	#1/0	1	1	208	120	27,657	125	6,545	N/A	N/A	1.71
FEEDER PDBA-19	110	3	Cu	#1/0	1	1	208	120	27,657	125	7,205	N/A	N/A	1.51
FEEDER PDBA-21	100	3	Cu	#1/0	1	1	208	120	27,657	125	7,724	N/A	N/A	1.37
FEEDER PDBA-23	125	3	Cu	#4/0	1	1	208	120	27,657	225	9,508	N/A	N/A	1.84

TRANSFORMERS

TRANSFORMER DESIGNATION	XFMR KVA	PHASE ϕ	XFMR %Z	XFMR PRIMARY L-L VOLTAGE	XFMR SECONDARY L-L VOLTAGE	XFMR PRIMARY Isc	XFMR PRIMARY FLA	XFMR SECONDARY FLA	WORST CASE XFMR %Z	WORST CASE L-L VOLTAGE	XFMR SECONDARY Isc L-L	XFMR SECONDARY Isc L-N	MOTOR CONTRIBUTION	TOTAL Isc
"USSC"	1500	3	5.75	4160	480	100,000	208	1804	5.18	528	36,887	N/A		36,887
"TA"	300	3	5.75	480	208	28,489	361	833	5.18	229	14,220	N/A		14,220
"TB"	300	3	5.75	480	208	28,489	361	833	5.18	229	14,220	N/A		14,220
"ETLS"	45	3	5.75	480	208	12,079	54	125	5.18	229	2,443	N/A		2,443
"ETEQ"	75	3	5.75	480	208	21,239	90	208	5.18	229	4,087	N/A		4,087

NOTES:
1. ALL SHORT CIRCUIT CALCULATIONS ARE BASED ON BUSSMAN POINT-TO-POINT METHOD.
2. ALL VOLTAGE DROP CALCULATIONS ARE BASED ON BUSSMAN VOLTAGE LOSS METHOD FOR 1f AND 3f CIRCUITS WITH 90% POWER FACTOR.
3. MOTOR CONTRIBUTION ASSUMES 6X FULL LOAD CURRENT OF MOTOR LOADS.
4. INFINITE BUS IS DEFINED AS 10,000,000

DATE: 9/20/2017

HGA
1918 Main Street,Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

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PASADENA, CA 91101
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17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

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SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA

LICENSED ARCHITECT JAMES G. MATSON No. C13036 STATE OF CALIFORNIA — EXPIRATION DATE: SEPTEMBER 30, 2017

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

SINGLE LINE DIAGRAM

DATE: JULY 06, 2017

E0.2B

ADDENDA PACKAGE

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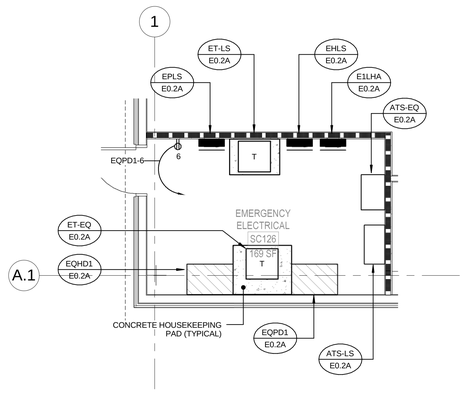
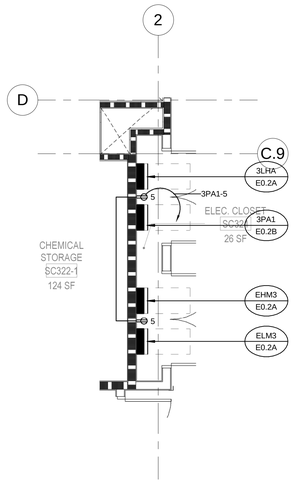
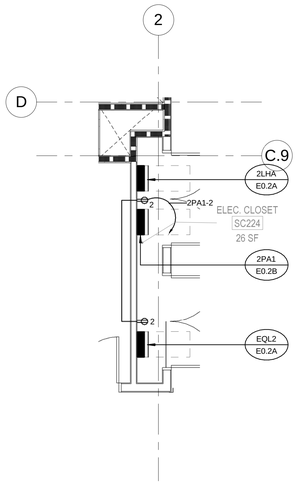


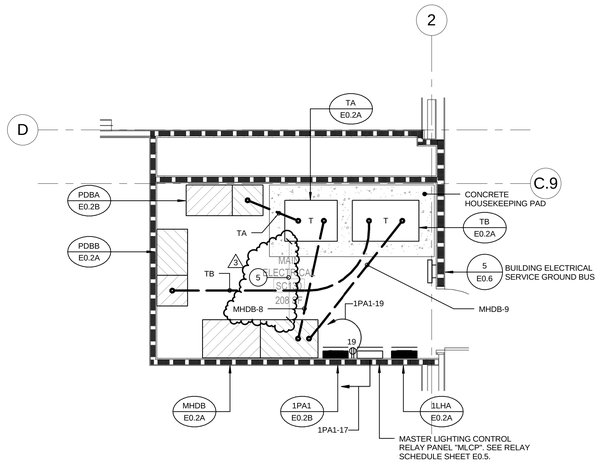
10 LEVEL 01 ENLARGED EMERGENCY ELECTRICAL ROOM
1/4" = 1'-0"



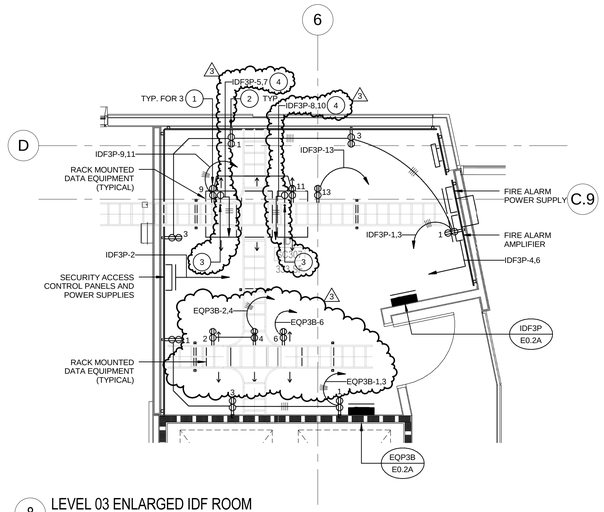
7 LEVEL 03 ENLARGED ELECTRICAL CLOSET 240
1/4" = 1'-0"



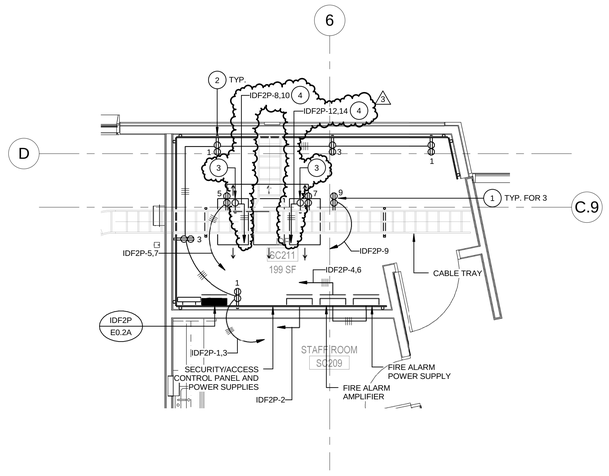
4 LEVEL 02 ENLARGED ELECTRICAL CLOSET 239
1/4" = 1'-0"



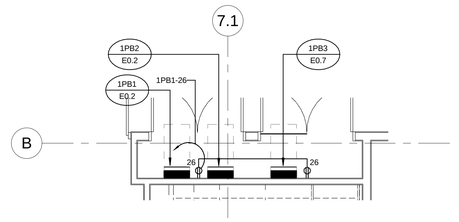
1 LEVEL 01 ENLARGED MAIN ELECTRICAL ROOM
1/4" = 1'-0"



8 LEVEL 03 ENLARGED IDF ROOM
1/4" = 1'-0"



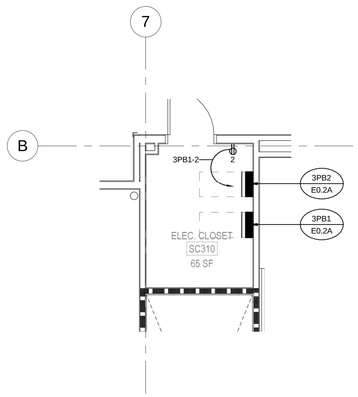
5 LEVEL 02 ENLARGED IDF ROOM
1/4" = 1'-0"



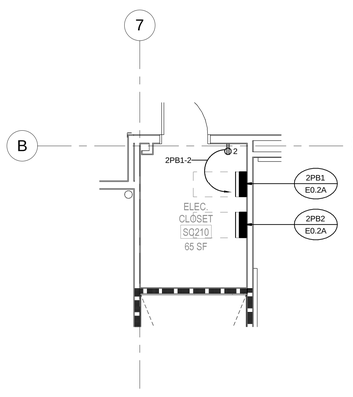
2 LEVEL 01 ENLARGED ELECTRICAL CLOSET 236
1/4" = 1'-0"

PLAN NOTES:

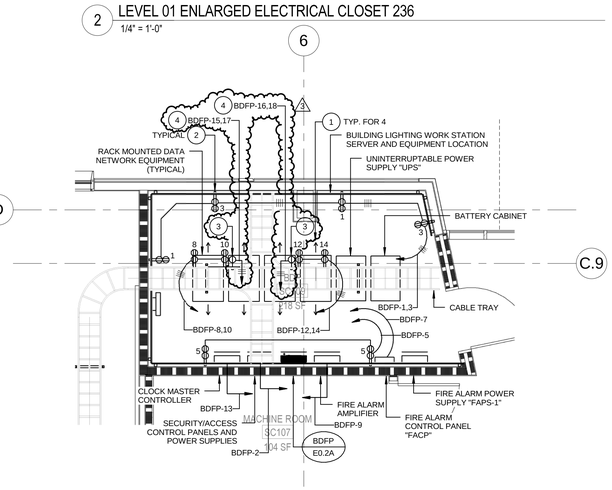
1. MOUNT 125V. 20AMP DOUBLE DUPLEX RECEPTACLES IN SURFACE MOUNTED OUTLET BOX ATTACHED TO THE SIDE OF THE CABLE TRAY.
2. MOUNT 125V. 20AMP DOUBLE DUPLEX RECEPTACLES IN RECESSED OUTLET BOXES MOUNTED FLUSH WITH THE PLYWOOD BACKBOARD.
3. PROVIDE 250V 30A 2PH 3W GROUNDING TYPE TWISTLOCK RECEPTACLE IN SURFACE MOUNTED OUTLET BOX ATTACHED TO THE SIDE OF THE CABLE TRAY.
4. PROVIDE 3#10, 1#10 GRD. - 3/4"C.
5. PROVIDE DOUBLE THE REQUIRED CLEARANCE.



9 LEVEL 03 ENLARGED ELECTRICAL CLOSET 238
1/4" = 1'-0"



6 LEVEL 02 ENLARGED ELECTRICAL CLOSET 237
1/4" = 1'-0"



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

1918 Main Street,Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

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150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
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KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
213-418-0201

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949-756-0150

LABORATORY CONSULTANT
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SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER

SANTA ANA COLLEGE

RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

ENLARGED ELECTRICAL AND TELECOM ROOMS

DATE: JULY 06, 2017

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ADDENDA PACKAGE

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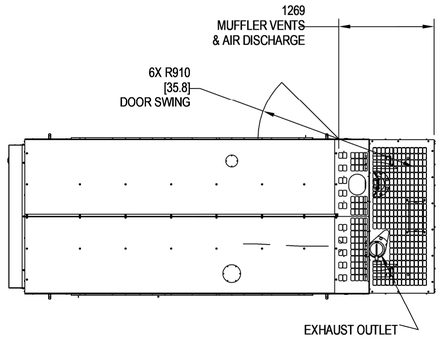
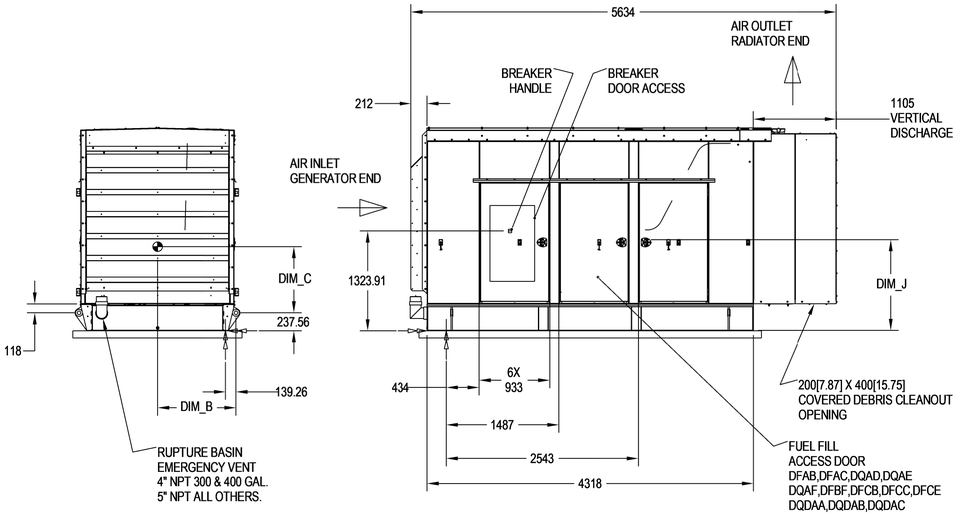
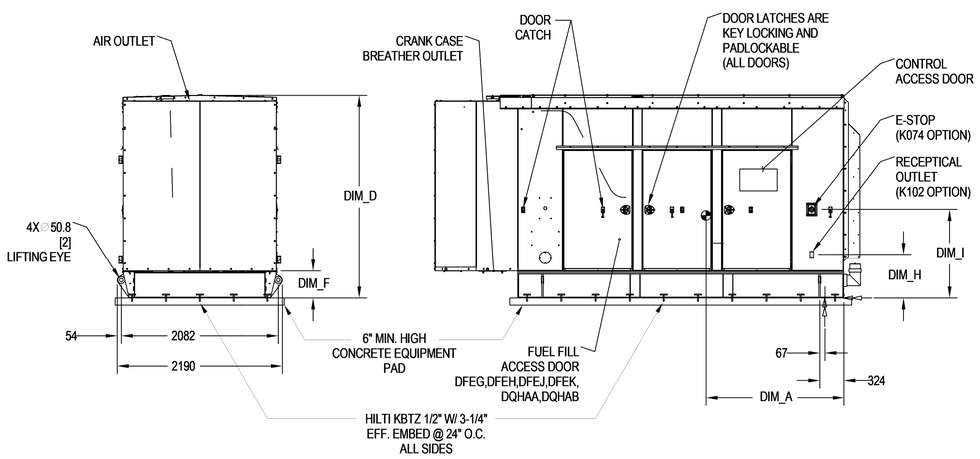




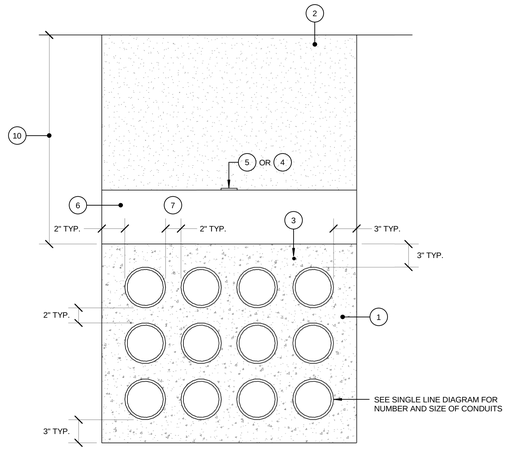


GENERATOR ENCLOSURE DETAIL

SCALE N.T.S. | 4

DRAWING SHEET PLAN NOTES

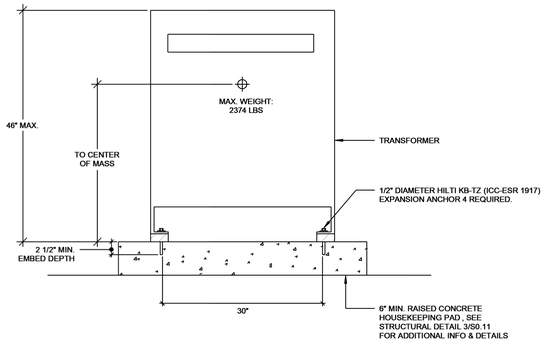
1. CAST-IN PLACE RED MIX CONCRETE CONTINUOUS ENTIRE LENGTH.CONCRETE COVERAGE NOT LESS THAN 3-INCH ALL SIDES OF CONDUIT DUCT BANK.
2. NATIVE SOIL BACKFILL.
3. CONTINUOUS 1#4/0 BARE COPPER DUCT BANK BONDING/GROUND CONDUCTOR.
4. CONTINUOUS 5 INCH CONDUIT AND 4160 VOLT CIRCUIT POWER CONDUCTORS.
5. 3" WIDE WARNING TAPE LOCATED 12" BELOW GRADE. TAPE SHALL INDICATE: "CAUTION BURIED ELECTRICAL CONDUIT".
6. DAMP SAND BACKFILL TO WITHIN 12" OF FINISH GRADE.
7. INTRA-CONDUIT SPACING 2 INCH.
8. HOMERUN AND CONNECT EQUIPMENT BOND CONDUCTOR TO BUILDING EQUIPMENT GROUND BUS - GB.
9. 1"C. - 1#8, CONNECT TO CABLE TRENCH EXPOSED METAL COVER/FRAME FOR CONTINUOUS BOND/GROUND OF EACH ISOLATED METAL COMPONENTS.
10. 36" IN TRAFFIC AREAS, 24" IN NON-TRAFFIC AREAS.



CROSS SECTION - CONCRETE FULLY ENCASED

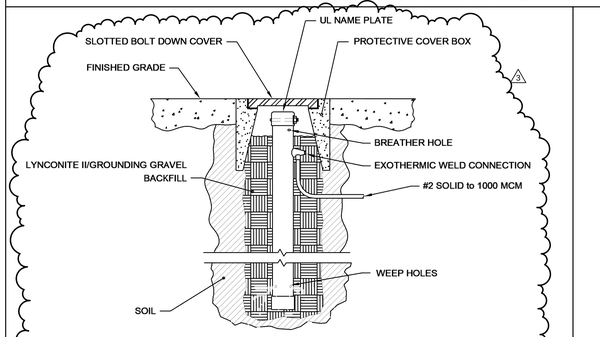
UNDERGROUND CONDUIT DUCT BANK DETAIL

SCALE N.T.S. | 1



TYPICAL TRANSFORMER ANCHORAGE DETAIL

SCALE N.T.S. | 2



LYNCOLE XIT GROUNDING SYSTEM

STRAIGHT SHAFT MODEL: INFORMATION & SPECIFICATIONS

A. Manufacturer: Lyncole XIT Grounding, 3547 Voyager St., Ste. 204 Torrance, CA 90503, Phone 800-962-2610. www.Lyncole.com

B. Shaft configuration: Straight. Standard lengths: 10', 12', 20' & 40', or custom.

C. UL and CSA Listing: 467.

D. Lynconite II and Grounding Gravel backfill meet ANSI/NSF Enviromental Standard 60.

E. Material: Type K Copper 0.083" nominal wall thickness.

F. Construction: Hollow tube, 2.125" O.D., filled with non-hazardous salts (Calsolyte).

G. Weight: 3.5 lbs per lineal foot.

H. Ground Wire Termination: Exothermic connection to conductors from #2 solid AWG to 1000 MCM. U-bolt with pressure plate provided as test point.

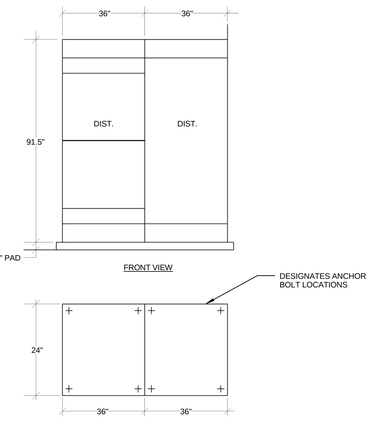
I. Warranty: 30 years. Minimum Life Expectancy: 50 years.

J. Straight Shaft Model No: K2-10CS, K2-12CS, K2-20CS, K2-2-40CS (coupled 20 ft. sections)

K. GSA Contract pricing Available.

GROUND ROD CHEMICAL DETAIL

SCALE N.T.S. | 5



DISTRIBUTION SWITCHBOARD ANCHORAGE DETAIL

SCALE N.T.S. | 3

1918 Main Street,Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
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SANTA ANA COLLEGE

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

DETAILS

DATE: JULY 06, 2017

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Branch Panel: 1PB1

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELECTRICAL CLOSET SC114 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Motor CORRIDOR SC100-1	1	20 A	1	500 VA	1860 VA					1	20 A	3	Receptacle Room SC101, SC100-1	2
3	Motor SCIENCE LEARNING CENTER SC103	1	20 A	1			500 VA	1040 VA			1	20 A	4	Receptacle MODEL STORAGE / LOCKERS...	4
5	Motor SCIENCE LEARNING CENTER SC103	1	20 A	1					500 VA	800 VA	1	20 A	1	Receptacle WORK ROOM SC110-2	6
7	Receptacle CONFERENCE SC103-2	3	20 A	1	540 VA	1500 VA					1	20 A	1	Receptacle WORK ROOM SC110-2	8
9	Receptacle Room SC103-2, SC103	3	20 A	1			540 VA	1860 VA			1	20 A	5	Receptacle OFFICE SC116-1	10
11	Receptacle WORK ROOM SC110-2	5	20 A	1					900 VA	540 VA	1	20 A	3	Receptacle OFFICE SC116-1	12
13	Receptacle WORK ROOM SC110-2	5	20 A	1	900 VA	2020 VA					1	20 A	6	Receptacle RECEPTION SC116	14
15	Receptacle WORK ROOM SC110-2	1	20 A	1			1200 VA	900 VA			1	20 A	5	Receptacle RECEPTION SC116	16
17	Receptacle WORK ROOM SC110-2	1	20 A	1					800 VA	1080 VA	1	20 A	6	Receptacle CONFERENCE SC110-3	18
19	Receptacle EXTERIOR GFI	1	20 A	1	180 VA	900 VA					1	20 A	5	Receptacle CONFERENCE SC110-3	20
21	Power LOBBY SC105	1	20 A	1			500 VA	180 VA			1	20 A	1	Receptacle MEN'S RESTROOM SC102	22
23	Receptacle Room SC106, SC102, SC104	4	20 A	1					720 VA	180 VA	1	20 A	1	Receptacle MEN'S RESTROOM SC102	24
25	Power ELECTRIC DRINKING FOUNTAIN	2	20 A	1	680 VA	360 VA					1	20 A	2	Receptacle ELECTRICAL CLOSET SC114	26
27	Receptacle OPEN OFFICE SC110-1	1	20 A	1			180 VA	500 VA			1	20 A	10	Power SC122, SC120, SC118, SC105......	28
29	Receptacle OPEN OFFICE SC110-1	1	20 A	1					1200 VA	100 VA	1	20 A	1	Power BELL	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	150 VA			1	20 A	3	Power MECHANICAL EQUIPMENT	34
35	Spare	--	20 A	1					0 VA	150 VA	1	20 A	3	Power MECHANICAL EQUIPMENT	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	9440 VA		7550 VA		6970 VA						
				Total Amps:	79 A		64 A		58 A						

3

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	2400 VA	Total Conn. Load:	23960 VA
Receptacle	20060 VA	Total Est. Demand:	18930 VA
Motor	1500 VA	Total Conn.:	67 A
Other	0 VA	Total Est. Demand:	53 A

Notes:

Branch Panel: 1PA1

SANTA ANA COLLEGE SCIENCE CENTER

Location: MAIN ELECTRICAL SC130 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBA **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Motor CORRIDOR SC100	1	20 A	1	500 VA	720 VA					1	20 A	4	Receptacle CORRIDOR SC100	2
3	Motor CORRIDOR SC100	1	20 A	1			500 VA	540 VA			1	20 A	3	Receptacle CORRIDOR SC100	4
5	Receptacle LARGE CLASSROOM (DIVISIBLE)...	4	20 A	1					720 VA	180 VA	1	20 A	1	Receptacle STORAGE SC124	6
7	Receptacle LARGE CLASSROOM (DIVISIBLE)...	4	20 A	1	720 VA	360 VA					1	20 A	2	Receptacle STORAGE SC124	8
9	Receptacle LARGE CLASSROOM (DIVISIBLE)...	4	20 A	1			720 VA	1800 VA			1	20 A	1	Receptacle MULTI DISC COMPUTER LAB...	10
11	Receptacle LARGE CLASSROOM (DIVISIBLE)...	4	20 A	1					720 VA	720 VA	1	20 A	4	Receptacle Room SC126, SC124, SC128	12
13	Receptacle MULTI DISC COMPUTER LAB...	3	20 A	1	540 VA	900 VA					1	20 A	5	Receptacle Room SC124, SC128, SC126	14
15	Power MULTI DISC COMPUTER LAB SC115	1	20 A	1			1000 VA	1800 VA			1	20 A	1	Receptacle LARGE CLASSROOM (DIVISIBLE)...	16
17	MLCP	1	20 A	1					500 VA	1800 VA	1	20 A	1	Receptacle LARGE CLASSROOM (DIVISIBLE)...	18
19	Receptacle MAIN ELECTRICAL SC130	1	20 A	1	180 VA	2000 VA					1	20 A	2	Power Room SC113-1, SC113-2	20
21	Receptacle	3	20 A	1			900 VA	400 VA			1	20 A	8	Power Room SC128, SC134,...	22
23	Receptacle	2	20 A	1					720 VA	50 VA	1	20 A	1	Power MECHANICAL EQUIPMENT	24
25	Power LARGE CLASSROOM (DIVISIBLE)...	1	20 A	1	500 VA	50 VA					1	20 A	1	Power MECHANICAL EQUIPMENT	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	6470 VA		7660 VA		5410 VA						
				Total Amps:	55 A		65 A		45 A						

3

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	4000 VA	Total Conn. Load:	19040 VA
Receptacle	14040 VA	Total Est. Demand:	17020 VA
Motor	1000 VA	Total Conn.:	53 A
Other	0 VA	Total Est. Demand:	47 A

Notes:

Branch Panel: 1LHA

SANTA ANA COLLEGE SCIENCE CENTER

Location: MAIN ELECTRICAL SC130 **Volts:** 480/277 Wye **A.I.C. Rating:**
Supply From: MHDB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Lighting Room SC124, SC128, SC130, SC132,...	43	20 A	1	2745 VA	2086 VA					1	20 A	63	Lighting Room SC100, SC100-1, SC105	2
3	Lighting Room SC113-1, SC113-2, SC115,...	45	20 A	1			6620 VA	225 VA			1	20 A	9	Lighting Room SC116,SC110-1,SC104,SC102	4
5	Lighting Room SC122, SC120, SC118	19	20 A	1					3121 VA	275 VA	1	20 A	11	Lighting BIG BOX EXTERIOR LIGHTING	6
7	Lighting Room SC118, SC120	23	20 A	1	3144 VA	305 VA					1	20 A	20	Lighting MURAL LIGHTING	8
9	Lighting OFFICE SC116-1	22	20 A	1			2575 VA	112 VA			1	20 A	1	Lighting SMALL BOX	10
11	Lighting CONFERENCE SC103-2	18	20 A	1					2845 VA	11926...	3	70 A	1	3LHA	12
13	2LHA	1	70 A	3	8763 VA	7233 VA					--	--	--	--	14
15	--	--	--	--			9635 VA	7056 VA			--	--	--	--	16
17	--	--	--	--					9187 VA	612 VA	1	20 A	12	Lighting GREEN HOUSE (2)	18
19	Lighting EXTERIOR LIGHTING	10	20 A	1	1500 VA	75 VA					1	20 A	3	Lighting EXTERIOR LIGHTING	20
21	Lighting EXTERIOR LIGHTING	11	20 A	1			1650 VA	1028 VA			1	20 A	7	Lighting EXTERIOR LIGHTING	22
23	Lighting EXTERIOR LIGHTING	5	20 A	1					250 VA	732 VA	1	20 A	5	Lighting EXTERIOR LIGHTING	24
25	Lighting EXTERIOR LIGHTING	6	20 A	1	300 VA	0 VA					1	20 A	--	Spare	26
27	Lighting EXTERIOR LIGHTING	6	20 A	1			300 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare (2)	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	26152 VA		29201 VA		28948 VA						
				Total Amps:	94 A		107 A		106 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	86118 VA		
Power	0 VA	Total Conn. Load:	86118 VA
Receptacle	0 VA	Total Est. Demand:	86118 VA
Motor	0 VA	Total Conn.:	104 A
Other	0 VA	Total Est. Demand:	104 A

Notes:

Branch Panel: W

SANTA ANA COLLEGE SCIENCE CENTER

Location: WELDING AREA SC229 **Volts:** 480/277 Wye **A.I.C. Rating:**
Supply From: **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 400 A
MCB Rating: 400 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle WELDING AREA	1	50 A	3	11095...	11095...					3	50 A	1	Receptacle WELDING AREA	2
3	--	--	--	--			11095...	11095...			--	--	--	--	4
5	--	--	--	--					11095...	11095...	--	--	--	--	6
7	Receptacle WELDING AREA	1	50 A	3	11095...	11095...					3	50 A	1	Receptacle WELDING AREA	8
9	--	--	--	--			11095...	11095...			--	--	--	--	10
11	--	--	--	--					11095...	11095...	--	--	--	--	12
13	Receptacle WELDING AREA	1	50 A	3	11095...	11095...					3	50 A	1	Receptacle WELDING AREA	14
15	--	--	--	--			11095...	11095...			--	--	--	--	16
17	--	--	--	--					11095...	11095...	--	--	--	--	18
19	Receptacle WELDING AREA	1	50 A	3	11095...	0 VA					1	20 A	--	Spare	20
21	--	--	--	--			11095...	0 VA			1	20 A	--	Spare	22
23	--	--	--	--					11095...	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	77665 VA		77665 VA		77665 VA						
				Total Amps:	280 A		280 A		280 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	0 VA	Total Conn. Load:	232995 VA
Receptacle	232995 VA	Total Est. Demand:	121498 VA
Motor	0 VA	Total Conn.:	280 A
Other	0 VA	Total Est. Demand:	146 A

Notes:

Branch Panel: BDFP

SANTA ANA COLLEGE SCIENCE CENTER

Location: BDF SC109 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 125 A

CKT	Circuit Description	Note	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Note	Circuit Description	CKT
1	Receptacle BDF SC109		2	20...	1	720 VA	1000 VA					1	20...	1		SECURITY/ACCESS CONTROLS	2
3	Receptacle BDF SC109		2	20...	1			720 VA	500 VA			1	20...	1		Power EMERGENCY PHONE	4
5	Receptacle BDF SC109		2	20...	1					720 VA	500 VA	1	20...	1		Power EMERGENCY PHONE	6
7	*FACP		1	20...	1	500 VA	180 VA					1	20...	1		Receptacle RACKS BDF SC109	8
9	*FA AMPLIFIER		1	20...	1			500 VA	180 VA			1	20...	1		Receptacle RACKS BDF SC109	10
11	*FA POWER SUPPLY		1	20...	1					500 VA	180 VA	1	20...	1		Power BDF SC109	12
13	CLOCK		1	20...	1	500 VA	180 VA					1	20...	1		Power BDF SC109	14
15	Receptacle BDF SC109 CABLE TRAY		1	20...	2			1000 VA	1000 VA			2	20...	1		Receptacle BDF SC109 CABLE TRAY	16
17	--		--	--	--					1000 VA	1000 VA	--	--	--		--	18
19	IDF2/IDF3		1	10...	3	3600 VA	0 VA					1	20...	--		Spare	20
21	--		--	--	--			3600 VA	0 VA			1	20...	--		Spare	22
23	--		--	--	--					3600 VA	0 VA	1	20...	--		Spare	24
25	Provision		--	--	--	0 VA	0 VA					--	--	--		Provision	26
27	Provision		--	--	--			0 VA	0 VA			--	--	--		Provision	28
29	Provision		--	--	--					0 VA	0 VA	--	--	--		Provision	30
31	Provision		--	--	--	0 VA	0 VA					--	--	--		Provision	32
33	Provision		--	--	--			0 VA	0 VA			--	--	--		Provision	34
35	Provision		--	--	--					0 VA	0 VA	--	--	--		Provision	36
37	Provision		--	--	--	0 VA	0 VA					--	--	--		Provision	38
39	Provision		--	--	--			0 VA	0 VA			--	--	--		Provision	40
41	Provision		--	--	--					0 VA	0 VA	--	--	--		Provision	42
					Total Load:	6680 VA		7500 VA		7500 VA							
					Total...	56 A		64 A		64 A							

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	11800 VA	Total Conn. Load:	18680 VA
Receptacle	6880 VA	Total Est. Demand:	18680 VA
Motor	0 VA	Total Conn.:	52 A
Other	0 VA	Total Est. Demand:	52 A

Notes:

Branch Panel: 1PB2

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELECTRICAL CLOSET SC114 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle CORRIDOR SC100-1	5	20 A	1	900 VA	272 VA					1	20 A	1	Motor MACHINE ROOM SC107	2
3	Receptacle MACHINE ROOM SC107	5	20 A	1			900 VA	272 VA			1	20 A	1	Motor MACHINE ROOM SC107	4
5	Receptacle LARGE CLASSROOM SC111	3	20 A	1					540 VA	272 VA	1	20 A	1	Motor MACHINE ROOM SC107	6
7	Receptacle LARGE CLASSROOM SC111	4	20 A	1	720 VA	272 VA					1	20 A	1	Motor MACHINE ROOM SC107	8
9	Receptacle LARGE CLASSROOM SC111	3	20 A	1			540 VA	1500 VA			1	20 A	1	Power WOMEN'S RESTROOM SC104	10
11	Receptacle LARGE CLASSROOM SC111	3	20 A	1					540 VA	3000 VA	1	20 A	6	Power WOMEN'S RESTROOM SC104	12
13	Receptacle SCIENCE LEARNING CENTER...	4	20 A	1	2040 VA	1500 VA					1	20 A	1	Power MEN'S RESTROOM SC102	14
15	Receptacle SCIENCE LEARNING CENTER...	4	20 A	1			720 VA	3000 VA			1	20 A	6	Power MEN'S RESTROOM SC102	16
17	Receptacle SCIENCE LEARNING CENTER...	4	20 A	1					720 VA	2000 VA	1	20 A	2	Power LARGE CLASSROOM SC111	18
19	Receptacle SCIENCE LEARNING CENTER...	1	20 A	1	180 VA	1800 VA					1	20 A	1	Receptacle LARGE CLASSROOM SC111	20
21	Power SCIENCE LEARNING CENTER SC103	1	20 A	1			1000 VA	1800 VA			1	20 A	1	Receptacle CONFERENCE SC110-3	22
23	Power SCIENCE LEARNING CENTER SC103	1	20 A	1					1000 VA	2000 VA	1	20 A	2	Power CONFERENCE SC110-3	24
25	Power SCIENCE LEARNING CENTER SC103	1	20 A	1	1000 VA	1000 VA					1	20 A	1	Power CONFERENCE SC110-3	26
27	Motor LARGE CLASSROOM SC111 COND....	1	20 A	1			500 VA	500 VA			1	20 A	1	Motor BDF SC109 CONDENSATE PUMP	28
29	Power Room SC100-1, SC118	3	20 A	1					3000 VA	100 VA	1	20 A	2	Power Room SC106 TRAP PRIMER	30
31	Power SCIENCE LEARNING CENTER SC103	4	20 A	1	1660 VA	100 VA					1	20 A	2	Power SC120 TRAP PRIMER	32
33	Receptacle CONFERENCE SC110-3	1	20 A	1			1800 VA	250 VA			1	20 A	5	Power SC128 TRAP PRIMER	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	11444 VA		12782 VA		13172 VA						
				Total Amps:	95 A		108 A		111 A						

3

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	21450 VA	Total Conn. Load:	37398 VA
Receptacle	13860 VA	Total Est. Demand:	35468 VA
Motor	2088 VA	Total Conn.:	104 A
Other	0 VA	Total Est. Demand:	98 A

Notes:

3

Branch Panel: 1PB3

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELECTRICAL CLOSET SC114 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle SC103	1	20 A	1	1500 VA	1800 VA					1	20 A	1	Receptacle SC103	2
3	Receptacle SC103	1	20 A	1			1500 VA	1800 VA			1	20 A	1	Receptacle SC103	4
5	Receptacle SC103	1	20 A	1					1500 VA	1800 VA	1	20 A	1	Receptacle SC103	6
7	Receptacle SC103	1	20 A	1	1500 VA	1800 VA					1	20 A	1	Receptacle SC103	8
9	Receptacle SC103	1	20 A	1			1500 VA	1800 VA			1	20 A	1	Receptacle SC103	10
11	Receptacle SC103	1	20 A	1					1500 VA	1800 VA	1	20 A	1	Receptacle SC103	12
13	Receptacle SC103	1	20 A	1	1500 VA	1800 VA					1	20 A	1	Receptacle SC103	14
15	Receptacle CONFERENCE SC103-2	1	20 A	1			1800 VA	1800 VA			1	20 A	1	Receptacle SC103	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	9900 VA		10200 VA		6600 VA						
				Total Amps:	87 A		89 A		55 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	0 VA	Total Conn. Load:	26700 VA
Receptacle	26700 VA	Total Est. Demand:	18350 VA
Motor	0 VA	Total Conn.:	74 A
Other	0 VA	Total Est. Demand:	51 A

Notes:

Branch Panel: IDF2P

SANTA ANA COLLEGE SCIENCE CENTER

Location: IDF SC211 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 70 A
Lugs Only: **MCB Rating:** 100 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle IDF SC211	3	20 A	1	1080...	500 VA					1	20 A	1	SECURITY/ACCESS CONTROLS	2
3	Receptacle IDF SC211	2	20 A	1			720 VA	1000...			1	20 A	1	*FA POWER SUPPLY	4
5	Receptacles Racks IDF SC211	1	20 A	1					0 VA	1000...	1	20 A	1	FA AMPLIFIER	6
7	Receptacles Racks IDF SC211	1	20 A	1	0 VA	1000...					2	20 A	1	Receptacle IDF SC211 CABLE TRAY	8
9	Receptacles Racks IDF SC211	1	20 A	1			0 VA	1000...			--	--	--	--	10
11	Spare	--	20 A	1					0 VA	1000...	2	20 A	1	Receptacle IDF SC211 CABLE TRAY	12
13	Spare	--	20 A	1	0 VA	1000...					--	--	--	--	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	20
21	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	22
23	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	24
25	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	26
27	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	28
29	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	30
				Total Load:	3580 VA		2720 VA		2000 VA						
				Total Amps:	31 A		24 A		17 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	0 VA	Total Conn. Load:	5800 VA
Receptacle	5800 VA	Total Est. Demand:	5800 VA
Motor	0 VA	Total Conn.:	16 A
Other	0 VA	Total Est. Demand:	16 A

Notes:
* PROVIDE CIRCUIT BREAKER LOCK ON DEVICE, RED IN COLOR.

Branch Panel: IDF3P

SANTA ANA COLLEGE SCIENCE CENTER

Location: IDF SC307 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 50 A
Lugs Only: **MCB Rating:** 100 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle IDF SC307	2	20 A	1	720 VA	1000...					1	20 A	1	FIRE ALARM TERMINAL CABINET	2
3	Receptacle IDF SC307	2	20 A	1			720 VA	500 VA			1	20 A	1	SECURITY/ACCESS CONTROLS	4
5	Receptacle IDF SC307 CABLE TRAY	1	20 A	2					1000...	1000...	1	20 A	1	FA AMPLIFIER	6
7	--	--	--	--	1000...	1000...					2	20 A	1	Receptacle IDF SC307	8
9	Receptacles Racks IDF SC307	1	20 A	1			500 VA	1000...			--	--	--	--	10
11	Receptacles Racks IDF SC307	1	20 A	1					500 VA	0 VA	1	20 A	--	Spare	12
13	Receptacles Racks IDF SC307	1	20 A	1	500 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					--	--	--	Provision	20
21	Spare	--	20 A	1			0 VA	0 VA			--	--	--	Provision	22
23	Spare	--	20 A	1					0 VA	0 VA	--	--	--	Provision	24
25	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	26
27	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	28
29	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	30
				Total Load:	4220 VA		2720 VA		2500 VA						
				Total Amps:	35 A		23 A		21 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	0 VA	Total Conn. Load:	6940 VA
Receptacle	6940 VA	Total Est. Demand:	6940 VA
Motor	0 VA	Total Conn.:	19 A
Other	0 VA	Total Est. Demand:	19 A

Notes:
PROVIDE CIRCUIT BREAKER LOCK ON DEVICE RED IN COLOR.

HGA
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE
RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA

LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA
REGISTERED PROFESSIONAL ENGINEER No. E 20372 Exp. 09-30-18 ELECTRICAL STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	ADDENDUM 2	9/1/17
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 01 PANEL SCHEDULES

DATE: JULY 06, 2017

ADDENDA PACKAGE

E0.7

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FBA

Branch Panel: HMW1

SANTA ANA COLLEGE SCIENCE CENTER

Location: MECHANICAL ROOM SC128 | Supply From: MHDB | Mounting: Surface
Volts: 480/277 Wye | Phases: 3 | Wires: 4
A.I.C. Rating: | Mains Type: | Mains Rating: 600 A | MCB Rating:

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	Power MECHANICAL ROOM SC128	1	20 A	3	2000 VA	2000 VA					3	20 A	1	Power MECHANICAL ROOM SC128	2
3	--	--	--	--			2000 VA	2000 VA			--	--	--	--	4
5	--	--	--	--					2000 VA	2000 VA	--	--	--	--	6
7	Power MECHANICAL ROOM SC128	1	80 A	3	18000...	26000...					3	100 A	1	Power MECHANICAL ROOM SC128	8
9	--	--	--	--			18000...	26000...			--	--	--	--	10
11	--	--	--	--					18000...	26000...	--	--	--	--	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	20
21	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	22
23	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	24
25	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	26
27	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	28
29	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	30
31	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	32
33	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	34
35	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	48000 VA		48000 VA		48000 VA						
				Total Amps:	173 A		173 A		173 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	144000 VA	Total Conn. Load:	144000 VA
Receptacle	0 VA	Total Est. Demand:	144000 VA
Motor	0 VA	Total Conn.:	173 A
Other	0 VA	Total Est. Demand:	173 A

Notes:

Branch Panel: EQPD1

SANTA ANA COLLEGE SCIENCE CENTER

Location: EMERGENCY ELECTRICAL... | Supply From: ET-EQ | Mounting:
Volts: 120/208 Wye | Phases: 3 | Wires: 4
A.I.C. Rating: | Mains Type: | Mains Rating: 400 A | MCB Rating: 300 A

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	FCU 1-1 & FCU 1-2	2	20 A	2	300 VA	600 VA					2	20 A	2	FCU 2-1 & FCU 3-2	2
3	--	--	--	--			300 VA	600 VA			--	--	--	--	4
5	Spare	--	20 A	1					0 VA	180 VA	1	20 A	1	Receptacle EMERGENCY ELECTRICAL SC126	6
7	UPS	1	125 A	3	10000...	1220 VA					3	100 A	1	EQP3B	8
9	--	--	--	--			10000...	860 VA			--	--	--	--	10
11	--	--	--	--					10000...	500 VA	--	--	--	--	12
13	EQL2	1	20 A	3	3200 VA	6500 VA					3	60 A	1	ELM3	14
15	--	--	--	--			3200 VA	6500 VA			--	--	--	--	16
17	--	--	--	--					1200 VA	6000 VA	--	--	--	--	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	21820 VA		21460 VA		17880 VA						
				Total Amps:	186 A		183 A		149 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	58100 VA	Total Conn. Load:	61160 VA
Receptacle	2760 VA	Total Est. Demand:	61160 VA
Motor	300 VA	Total Conn.:	170 A
Other	0 VA	Total Est. Demand:	170 A

Notes:

Branch Panel: E1LHA

SANTA ANA COLLEGE SCIENCE CENTER

Location: EMERGENCY ELECTRICAL... | Supply From: EHLS | Mounting: Surface
Volts: 480/277 Wye | Phases: 3 | Wires: 4
A.I.C. Rating: | Mains Type: | Mains Rating: 225 A | MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	Lighting Room SC100, SC100-1, SC105	22	20 A	1	520 VA	192 VA					1	20 A	12	Lighting Exterior Downlights	2
3	Lighting SC126, SC128, SC132, SC134,...	21	20 A	1			1787 VA	457 VA			1	20 A	18	Lighting CORRIDOR SC300	4
5	Lighting Room SC122, SC120, SC118, SC111,...	30	20 A	1					3255 VA	3131 VA	1	20 A	30	Lighting ORGANIC CHEMISTRY LAB SC320	6
7	Lighting Room SC215, SC217-1, SC218, SC22...	28	20 A	1	2918 VA	2403 VA					1	20 A	28	Lighting CHEMISTRY LAB SC316	8
9	Lighting MOLECULAR BIOLOGY PREP &...	23	20 A	1			2120 VA	644 VA			1	20 A	23	Lighting STAIR #1 LIGHTING	10
11	Lighting CORRIDOR SC200	26	20 A	1					1017 VA	0 VA	1	20 A	6	Lighting OPEN OFFICE SC110-1	12
13	Lighting EXTERIOR LIGHTING	4	20 A	1	600 VA	0 VA					1	20 A	--	Spare	14
15	Lighting EXTERIOR LIGHTING	5	20 A	1			750 VA	0 VA			1	20 A	--	Spare	16
17	Lighting EXTERIOR LIGHTING	3	20 A	1					150 VA	0 VA	1	20 A	--	Spare	18
19	Lighting EXTERIOR LIGHTING	4	20 A	1	600 VA	0 VA					1	20 A	--	Spare	20
21	Lighting EXTERIOR LIGHTING	1	20 A	1			150 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	7233 VA		5908 VA		7554 VA						
				Total Amps:	27 A		21 A		28 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	20914 VA		
Power	0 VA	Total Conn. Load:	20914 VA
Receptacle	0 VA	Total Est. Demand:	20914 VA
Motor	0 VA	Total Conn.:	25 A
Other	0 VA	Total Est. Demand:	25 A

Notes:

Branch Panel: EPLS

SANTA ANA COLLEGE SCIENCE CENTER

Location: EMERGENCY ELECTRICAL... | Supply From: ET-LS | Mounting: Surface
Volts: 120/208 Wye | Phases: 3 | Wires: 4
A.I.C. Rating: | Mains Type: | Mains Rating: 225 A | MCB Rating: 175 A

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle BDF SC109	1	20 A	1	500 VA	4200 VA					3	70 A	1	CPP	2
3	Receptacle IDF SC211	1	20 A	1			500 VA	4200 VA			--	--	--	--	4
5	Receptacle IDF SC307	1	20 A	1					500 VA	4200 VA	--	--	--	--	6
7	Power SC115, SC113-2, SC100, SC130 F...	6	20 A	1	300 VA	452 VA					3	40 A	1	EPG	8
9	Power SC124, SC113-1, SC111 FIRE DAMPERS	5	20 A	1			250 VA	75 VA			--	--	--	--	10
11	Power CORRIDOR SC100-1 FIRE DAMPERS	3	20 A	1					150 VA	360 VA	--	--	--	--	12
13	Power SC116, SC116-1 FIRE DAMPERS	5	20 A	1	250 VA	0 VA					1	20 A	--	Spare	14
15	Power SMOKE FIRE DAMPER	3	20 A	1			150 VA	0 VA			1	20 A	--	Spare	16
17	Power SMOKE FIRE DAMPER	3	20 A	1					150 VA	0 VA	1	20 A	--	Spare	18
19	Power SMOKE FIRE DAMPER	5	20 A	1	250 VA	0 VA					1	20 A	--	Spare	20
21	Power SMOKE FIRE DAMPER	12	20 A	1			600 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	5952 VA		5775 VA		5360 VA						
				Total Amps:	50 A		49 A		45 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	175 VA		
Power	14700 VA	Total Conn. Load:	17095 VA
Receptacle	2220 VA	Total Est. Demand:	17095 VA
Motor	0 VA	Total Conn.:	47 A
Other	0 VA	Total Est. Demand:	47 A

Notes:

Branch Panel: EHLS

SANTA ANA COLLEGE SCIENCE CENTER

Location: EMERGENCY ELECTRICAL... | Supply From: ATS-LS | Mounting: Surface
Volts: 480/277 Wye | Phases: 3 | Wires: 4
A.I.C. Rating: | Mains Type: | Mains Rating: 150 A | MCB Rating:

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	E1LHA	1	20 A	3	7233 VA	5950 VA					3	20 A	1	ET-LS	2
3	--	--	--	--			5897 VA	5768 VA			--	--	--	--	4
5	--	--	--	--					7554 VA	5360 VA	--	--	--	--	6
7	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	13184 VA		11664 VA		12914 VA						
				Total Amps:	48 A		42 A		47 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	21089 VA		
Power	14700 VA	Total Conn. Load:	38009 VA
Receptacle	2220 VA	Total Est. Demand:	38009 VA
Motor	0 VA	Total Conn.:	46 A
Other	0 VA	Total Est. Demand:	46 A

Notes:

Branch Panel: LMW1

SANTA ANA COLLEGE SCIENCE CENTER

Location: MECHANICAL ROOM SC128 | Supply From: PDBA | Mounting: Surface
Volts: 120/208 Wye | Phases: 3 | Wires: 4
A.I.C. Rating: | Mains Type: | Mains Rating: 225 A | MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	B-1	1	20 A	2	1200 VA	500 VA					1	20 A	1	EF-5 (3/4 HP)	2
3	--	--	--	--			1200 VA	1000 VA			2	20 A	1	FCU-1-4	4
5	B-2	1	20 A	2					1200 VA	1000 VA	--	--	--	--	6
7	--	--	--	--	1200 VA	1000 VA					2	20 A	1	FCU-1-3	8
9	B-3	1	20 A	2			1200 VA	1000 VA			--	--	--	--	10
11	--	--	--	--					1200 VA	1200 VA	1	20 A	1	CRP-1	12
13	FPTU-1	1	20 A	1	1000 VA	1200 VA					1	20 A	1	CRP-2	14
15	FPTU-2	1	20 A	1			1000 VA	1200 VA			1	20 A	1	CRP-3	16
17	FPTU-3	1	20 A	1					1000 VA	1200 VA	1	20 A	1	CRP-4	18
19	CDP-1 (1/5 HP)	1	20 A	1	500 VA	0 VA					1	20 A	--	Spare	20
21	CDP-1	3	20 A	1			1600 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	6600 VA		8200 VA		6800 VA						
				Total Amps:	55 A		69 A		57 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	4800 VA		
Power	15800 VA	Total Conn. Load:	21600 VA
Receptacle	0 VA	Total Est. Demand:	21600 VA
Motor	1000 VA	Total Conn.:	60 A
Other	0 VA	Total Est. Demand:	60 A

Notes:

Subject: LOAD CALCULATION
Project: SANTA ANA COLLEGE SCIENCE CENTER
Panel: EQHD1
Location: EMERGENCY ELECTRICAL SC126
Supply From: ATS-EQ

Notes:

CKT	Circuit Description	Load	Apparent Current
1	ET-EQ	60391 VA	73 A
2	EQM3	30000 VA	36 A
3			
4			
5			
6			
7			
8			
9			
10			
		Total Connected Load:	91160 VA
		Total Connected Amps:	110 A

Branch Panel: CPP

SANTA ANA COLLEGE SCIENCECENTER

Location: GENERATOR S1 | Supply From: EPLS | Mounting: NEMA 4X
Volts: 120/208 Wye | Phases: 3 | Wires: 4 | Lugs Only:
A.I.C. Rating: | Mains Type: | Mains Rating: 100 A | MCB Rating: 100 A

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	GENERATOR CONV. RECEPTACLES	2	20 A	1	180 VA	1500 VA					1	20 A	1	BATTERY CHARGER	2
3	BLOCK HEATER	1	50 A	3			4200 VA	1200 VA			1	20 A	1	PUMPS	4
5	--	--	--	--					4200 KVA		1	20 A		SPARE	6
7	--	--	--	--	1000 VA						1	20 A		SPARE	8
9	SPARE	1	50 A	3			1000 VA				1	20 A		SPARE	10
11	--	--	--	--					1000 VA	1000 VA	3	30 A	1	SPARE	12
13	--	--	--	--	1000 VA	1000 VA					--		--	--	14
15								1000 VA			--		--	--	16
17															18
19															20
21															22
23															24
				Total Load:	4680 VA		7400 VA		6200 VA						
				Total Amps:	35 A		35 A		35 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	0 VA		
Power	12600 VA	Total Conn. Load:	18280 VA
Receptacle	0 VA	Total Est. Demand:	18280 VA
Motor	0 VA	Total Conn.:	35 A
Other	0 VA	Total Est. Demand:	35 A

Notes:
REFER TO STANDBY POWER SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

Branch Panel: EPG

SANTA ANA COLLEGE SCIENCE CENTER

Location: GENERATOR S1 | Supply From: EPLS | Mounting: Surface
Volts: 120/208 Wye | Phases: 3 | Wires: 4
A.I.C. Rating: | Mains Type: | Mains Rating: 225 A | MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A	A	B	B	C	C	Pole	Trip	Quan	Circuit Description	CKT
1	Lighting ELECTRICAL ENCLOSURE	4	20 A	1	100 VA	0 VA					1	20 A	--	Spare	2
3	Lighting ELECTRICAL ENCLOSURE	3	20 A	1			75 VA	0 VA			1	20 A	--	Spare	4
5	Receptacle ELETRICAL ENCLOSURE	2	20 A	1					360 VA	0 VA	1	20 A	--	Spare	6
7	Receptacle ELECTRICAL ENCLOSURE	2	20 A	1	360 VA	0 VA					1	20 A	--	Spare	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	460 VA		75 VA		360 VA						
				Total Amps:	4 A		1 A		3 A						

Legend:

Load Classification	Connected Load	Panel Totals	
Lighting	175 VA		
Power	0 VA	Total Conn. Load:	895 VA
Receptacle	720 VA	Total Est. Demand:	895 VA
Motor	0 VA	Total Conn.:	2 A
Other	0 VA	Total Est. Demand:	2 A

Notes:

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SANTA ANA COLLEGE
RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA

LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA
REGISTERED PROFESSIONAL ENGINEER No. E 20372 Exp. 09-30-18 ELECTRICAL STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
2	ADDENDUM 2	9/1/17
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 01 PANEL SCHEDULES

DATE: JULY 06, 2017

ADDENDA PACKAGE

E0.7A

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9/21/2017 7:33:01 PM
FBA

Branch Panel: 2LHA

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC224
Supply From: 1LHA
Mounting: Surface

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating:
Mains Type:
Mains Rating: 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Lighting ORGANISMAL BIOLOGY LAB SC226	20	20 A	1	3438 VA	1887 VA					1	20 A	56	Lighting CORRIDOR SC200	2
3	Lighting Room SC217, SC217-1, SC215	28	20 A	1			4012 VA	1839 VA			1	20 A	15	Lighting Room SC210, SC208, SC206, SC204,...	4
5	Lighting Room SC213, SC209, SC211	25	20 A	1					3473 VA	1812 VA	1	20 A	21	Lighting Room SC201-7, SC201-6, SC201-5,...	6
7	Lighting MICROBIOLOGY SC216	20	20 A	1	3438 VA	0 VA					1	20 A	--	Spare	8
9	Lighting Room SC214, SC212	26	20 A	1			3786 VA	0 VA			1	20 A	--	Spare	10
11	Lighting Room SC222, SC220, SC218	30	20 A	1					3903 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
			Total Load:		8763 VA		9637 VA		9188 VA						
			Total Amps:		32 A		35 A		33 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	27929 VA				
Power	0 VA			**Total Conn. Load:**	27929 VA
Receptacle	0 VA			**Total Est. Demand:**	27929 VA
Motor	0 VA			**Total Conn.:**	34 A
Other	0 VA			**Total Est. Demand:**	34 A

Notes:

3

Branch Panel: EQL2

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC224
Supply From: EQPD1
Mounting: Surface

Volts: 120/208 Wye
Phases: 3
Wires: 4
Lugs Only: No

A.I.C. Rating:
Mains Type:
Mains Rating: 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Power ELEC. CLOSET SC224	1	20 A	1	1200...	2000...					2	40 A	1	Power ELEC. CLOSET SC224	2
3	Power ELEC. CLOSET SC224	1	20 A	1			1200...	2000...			--	--	--	--	4
5	Power ELEC. CLOSET SC224	1	20 A	1					1200...	0 VA	1	20 A	--	Spare	6
7	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	26
27	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	28
29	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	30
			Total Load:		3200 VA		3200 VA		1200 VA						
			Total Amps:		29 A		29 A		10 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	7600 VA			**Total Conn. Load:**	7600 VA
Receptacle	0 VA			**Total Est. Demand:**	7600 VA
Motor	0 VA			**Total Conn.:**	21 A
Other	0 VA			**Total Est. Demand:**	21 A

Notes:

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 02 PANEL SCHEDULES

DATE: JULY 06, 2017

E0.7B

ADDENDA PACKAGE

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Branch Panel: 2PA1

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC224 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBA **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle CORRIDOR SC200	7	20 A	1	900 VA	360 VA					1	20 A	2	Receptacle ELEC. CLOSET SC224	2
3	Receptacle WASTE SC222	5	20 A	1			900 VA	360 VA			1	20 A	2	Receptacle CORRIDOR SC200	4
5	Power MECHANICAL EQUIPMENT	3	20 A	1					900 VA	450 VA	1	20 A	9	Power SC217, SC217-1, SC226,...CLOCKS	6
7	Power MECHANICAL EQUIPMENT	4	20 A	1	1200 VA	0 VA					1	20 A	--	Spare	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
			Total Load:		2460 VA		1260 VA		1350 VA						
			Total Amps:		21 A		11 A		11 A						

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	2550 VA			**Total Conn. Load:**	5070 VA
Receptacle	2520 VA			**Total Est. Demand:**	5070 VA
Motor	0 VA			**Total Conn.:**	14 A
Other	0 VA			**Total Est. Demand:**	14 A

Notes:

Branch Panel: EQL2

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC224 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: EQPD1 **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
Lugs Only: No **MCB Rating:** 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Power ELEC. CLOSET SC224	1	20 A	1	1200...	2000...					2	40 A	1	Power ELEC. CLOSET SC224	2
3	Power ELEC. CLOSET SC224	1	20 A	1			1200...	2000...			--	--	--	--	4
5	Power ELEC. CLOSET SC224	1	20 A	1					1200...	0 VA	1	20 A	--	Spare	6
7	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	26
27	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	28
29	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	30
			Total Load:		3200 VA		3200 VA		1200 VA						
			Total Amps:		29 A		29 A		10 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	7600 VA			**Total Conn. Load:**	7600 VA
Receptacle	0 VA			**Total Est. Demand:**	7600 VA
Motor	0 VA			**Total Conn.:**	21 A
Other	0 VA			**Total Est. Demand:**	21 A

Notes:

Branch Panel: 2PB2

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC210 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle CONFERENCE SC110-3	1	20 A	1	1800 VA	250 VA					1	20 A	5	Power SC212, SC208, SC214 - SC216 TRAP...	2
3	Power CLASSROOM SC208	1	20 A	1			1000 VA	150 VA			1	20 A	3	Power SC217, SC226, SC220 TRAP PRIMER	4
5	Power SC201-7, SC201-6, SC201-5,...CLOCKS	12	20 A	1					600 VA	0 VA	1	20 A	--	Spare	6
7	Power MECHANICAL EQUIPMENT	3	20 A	1	900 VA	0 VA					1	20 A	--	Spare	8
9	Power MECHANICAL EQUIPMENT	3	20 A	1			900 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
			Total Load:		2950 VA		2050 VA		600 VA						
			Total Amps:		26 A		19 A		5 A						

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	3800 VA			**Total Conn. Load:**	5600 VA
Receptacle	1800 VA			**Total Est. Demand:**	5600 VA
Motor	0 VA			**Total Conn.:**	16 A
Other	0 VA			**Total Est. Demand:**	16 A

Notes:

Branch Panel: 2PB1

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC210 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Note	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Note	Circuit Description	CKT
1	Receptacle VENDING SC228		1	20...	1	180 VA	180 VA					1	20...	1		Receptacle ELEC. CLOSET SC210	2
3	Receptacle VENDING SC228		1	20...	1			180 VA	800 VA			1	20...	1		Receptacle CORR. C201-8C...	4
5	Receptacle CORRIDOR SC207 MOD...		12	20...	1					2160 VA	5000 VA	1	20...	8		Power MEN'S RESTROOM SC202	6
7	Receptacle COR SC201-8B PRINTER		1	20...	1	180 VA	800 VA					1	20...	1		Receptacle CORR. C201-8C GARB DISP	8
9	Power WOMEN'S RESTROOM SC204		8	20...	1			5000 VA	900 VA			1	20...	3		Receptacle OFFICE SC201-2	10
11	Receptacle STORAGE SC209		1	20...	1					800 VA	540 VA	1	20...	3		Receptacle OFFICE SC201-2	12
13	Receptacle CLASSROOM SC208		5	20...	1	900 VA	720 VA					1	20...	4		Receptacle OFFICE SC201-1	14
15	Receptacle CLASSROOM SC208		5	20...	1			900 VA	720 VA			1	20...	2		Receptacle OFFICE SC201-1	16
17	Receptacle OFFICE SC201-5		4	20...	1					720 VA	720 VA	1	20...	4		Receptacle OFFICE SC201-3	18
19	Receptacle OFFICE SC201-5		2	20...	1	720 VA	720 VA					1	20...	2		Receptacle OFFICE SC201-3	20
21	Receptacle OFFICE SC201-5		2	20...	1			360 VA	720 VA			1	20...	2		Receptacle OFFICE SC201-4	22
23	Receptacle OFFICE SC201-6		4	20...	1					1080 VA	720 VA	1	20...	4		Receptacle OFFICE SC201-4	24
25	Receptacle OFFICE SC201-7		4	20...	1	720 VA	720 VA					1	20...	4		Receptacle CORRIDOR SC200-1	26
27	Receptacle OFFICE SC201-7		2	20...	1			720 VA	1740 VA			1	20...	4		Receptacle Room SC200-1, SC209	28
29	Receptacle WORK STATIONS SC201		3	20...	1					900 VA	1080 VA	1	20...	6		Receptacle	30
31	Receptacle WORK STATIONS SC201		2	20...	1	360 VA	680 VA					1	20...	2		Receptacle RESTROOM SC203	32
33	Receptacle WORK STATIONS SC201		3	20...	1			540 VA	1200 VA			1	20...	1		Receptacle CORRIDOR SC201-8C	34
35	Receptacle WORK STATIONS SC201		1	20...	1					180 VA	1200 VA	1	20...	1		Receptacle CORRIDOR SC201-8C	36
37	Receptacle FB WORK STATIONS SC201		1	20...	1	1800 VA	900 VA					1	20...	6		Room SC200-1, SC204, SC206, SC202	38
39	Spare		--	20...	1			0 VA	100 VA			1	20...	1		Power DOOR HOLDER	40
41	Spare		--	20...	1					0 VA	0 VA	1	20...	--		Spare	42
				Total Load:		9580 VA		13880 VA		15100 VA							
				Total...		80 A		121 A		131 A							

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	10600 VA			**Total Conn. Load:**	38560 VA
Receptacle	27960 VA			**Total Est. Demand:**	29580 VA
Motor	0 VA			**Total Conn.:**	107 A
Other	0 VA			**Total Est. Demand:**	82 A

Notes:

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SCIENCE CENTER
SANTA ANA COLLEGE
RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CA

LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER No. E 20372 Exp. 09-30-18 ELECTRICAL STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 02 PANEL SCHEDULES

DATE: JULY 06, 2017

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Branch Panel: 3LHA

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC324
Supply From: 1LHA
Mounting: Surface

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating:
Mains Type:
Mains Rating: 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Lighting CHEMISTRY LAB SC326	20	20 A	1	3438 VA	1692 VA					1	20 A	59	Lighting CORRIDOR SC300	2
3	Lighting Room SC315, SC313	28	20 A	1			3902 VA	3331 VA			1	20 A	26	Lighting Room SC320, SC322, SC322-2,...	4
5	Lighting Room SC311, SC309, SC307	26	20 A	1					3450 VA	3612 VA	1	20 A	23	Lighting CHEMISTRY PREP & STORAGE...	6
7	Lighting Room SC310, SC308, SC301-7,...	37	20 A	1	3653 VA	3144 VA					1	20 A	23	Lighting PHYSICS PREP & STORAGE SC314	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
			Total Load:		11927 VA		7233 VA		7062 VA						
			Total Amps:		43 A		26 A		25 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	26604 VA				
Power	0 VA			**Total Conn. Load:**	26604 VA
Receptacle	0 VA			**Total Est. Demand:**	26604 VA
Motor	0 VA			**Total Conn.:**	32 A
Other	0 VA			**Total Est. Demand:**	32 A

Notes:

Branch Panel: EQP3B

SANTA ANA COLLEGE SCIENCE CENTER

Location: IDF SC307
Supply From: EQPD1
Mounting: Surface

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating:
Mains Type:
Mains Rating: 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle IDF SC307	2	20 A	1	720 VA	500 VA					1	20 A	1	Receptacle IDF SC307 ANTENNA RACK	2
3	Receptacle IDF SC307	1	20 A	1			360 VA	500 VA			1	20 A	1	Receptacle IDF SC307 ANTENNA RACK	4
5	Spare	--	20 A	1					0 VA	500 VA	1	20 A	1	Receptacle IDF SC307 ANTENNA RACK	6
7	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
			Total Load:		1220 VA		860 VA		500 VA						
			Total Amps:		11 A		8 A		4 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	0 VA			**Total Conn. Load:**	2580 VA
Receptacle	2580 VA			**Total Est. Demand:**	2580 VA
Motor	0 VA			**Total Conn.:**	7 A
Other	0 VA			**Total Est. Demand:**	7 A

Notes:

2

Branch Panel: EQM3

SANTA ANA COLLEGE SCIENCE CENTER

Location: ROOF SC230
Supply From: EQHD1
Mounting: Surface

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating:
Mains Type:
Mains Rating: 225 A
MCB Rating: 400 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	EF-1	1	50 A	3	2000 VA	2000 VA					3	50 A	1	EF-2	2
3	--	--	--	--			2000 VA	2000 VA			--	--	--	--	4
5	--	--	--	--					2000 VA	2000 VA	--	--	--	--	6
7	EF-3	1	50 A	3	2000 VA	2000 VA					3	50 A	1	EF-4	8
9	--	--	--	--			2000 VA	2000 VA			--	--	--	--	10
11	--	--	--	--					2000 VA	2000 VA	--	--	--	--	12
13	PAC-1	1	30 A	3	2000 VA	0 VA					1	20 A	--	Spare	14
15	--	--	--	--			2000 VA	0 VA			1	20 A	--	Spare	16
17	--	--	--	--					2000 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
			Total Load:		10000 VA		10000 VA		10000 VA						
			Total Amps:		36 A		36 A		36 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	30000 VA			**Total Conn. Load:**	30000 VA
Receptacle	0 VA			**Total Est. Demand:**	30000 VA
Motor	0 VA			**Total Conn.:**	36 A
Other	0 VA			**Total Est. Demand:**	36 A

Notes:

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IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE
RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 03 PANEL SCHEDULES

DATE: JULY 06, 2017

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ADDENDA PACKAGE

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Branch Panel: 3PB1

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC310 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle VENDING SC328	1	20 A	1	180 VA	180 VA					1	20 A	1	Receptacle ELEC. CLOSET SC310	2
3	Receptacle VENDING SC328	1	20 A	1			180 VA	800 VA			1	20 A	1	Receptacle CORRIDOR SC301-8C	4
5	Spare	--	20 A	1					0 VA	5000 VA	1	20 A	8	Power MEN'S RESTROOM SC302	6
7	Receptacle CORRIDOR SC301-8B	1	20 A	1	180 VA	800 VA					1	20 A	1	Receptacle CORRIDOR SC301-8C	8
9	Power WOMEN'S RESTROOM SC304	8	20 A	1			5000 VA	720 VA			1	20 A	4	Receptacle OFFICE SC301-2	10
11	Receptacle FB WORK STATIONS SC301	1	20 A	1					1800 VA	720 VA	1	20 A	2	Receptacle OFFICE SC301-2	12
13	Receptacle CLASSROOM SC308	6	20 A	1	1080 VA	720 VA					1	20 A	4	Receptacle OFFICE SC301-1	14
15	Receptacle CLASSROOM SC308	4	20 A	1			720 VA	720 VA			1	20 A	2	Receptacle OFFICE SC301-1	16
17	Receptacle OFFICE SC301-5	4	20 A	1					720 VA	720 VA	1	20 A	4	Receptacle OFFICE SC301-3	18
19	Receptacle OFFICE SC301-5	2	20 A	1	720 VA	720 VA					1	20 A	2	Receptacle OFFICE SC301-3	20
21	Receptacle OFFICE SC301-6	4	20 A	1			720 VA	720 VA			1	20 A	2	Receptacle OFFICE SC301-4	22
23	Receptacle OFFICE SC301-6	2	20 A	1					720 VA	720 VA	1	20 A	4	Receptacle OFFICE SC301-4	24
25	Receptacle OFFICE SC301-7	4	20 A	1	720 VA	900 VA					1	20 A	5	Receptacle Room SC302, SC306, SC304	26
27	Receptacle OFFICE SC301-7	2	20 A	1			720 VA	1080 VA			1	20 A	6	Receptacle Space SC322-53	28
29	Receptacle WORK STATIONS SC301	3	20 A	1					900 VA	1080 VA	1	20 A	6	Receptacle COLLABO SC305	30
31	Receptacle WORK STATIONS SC301	2	20 A	1	360 VA	680 VA					1	20 A	2	Receptacle RESTROOM SC303	32
33	Receptacle WORK STATIONS SC301	3	20 A	1			720 VA	1200 VA			1	20 A	1	Receptacle CORRIDOR SC301-8C	34
35	Receptacle WORK STATIONS SC301	1	20 A	1					180 VA	1200 VA	1	20 A	1	Receptacle CORRIDOR SC301-8C	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	7240 VA		13300 VA		13760 VA						
				Total Amps:	60 A		119 A		122 A						

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	10500 VA			**Total Conn. Load:**	34300 VA
Receptacle	23800 VA			**Total Est. Demand:**	27400 VA
Motor	0 VA			**Total Conn.:**	95 A
Other	0 VA			**Total Est. Demand:**	76 A

Notes:

Branch Panel: 3PA1

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC324 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBA **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle CORRIDOR SC300	4	20 A	1	720 VA	360 VA					1	20 A	2	Receptacle CORRIDOR SC300	2
3	Receptacle CORRIDOR SC300	3	20 A	1			540 VA	450 VA			1	20 A	9	Power Room SC322-53, SC309,...CLOCKS	4
5	Receptacle ELEC. CLOSET SC324	2	20 A	1					360 VA	900 VA	1	20 A	3	Power MECHANICAL EQUIPMENT	6
7	Spare	--	20 A	1	0 VA	1800 VA					1	20 A	6	Power MECHANICAL EQUIPMENT	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	2880 VA		990 VA		1260 VA						
				Total Amps:	24 A		8 A		11 A						

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	3150 VA			**Total Conn. Load:**	5130 VA
Receptacle	1980 VA			**Total Est. Demand:**	5130 VA
Motor	0 VA			**Total Conn.:**	14 A
Other	0 VA			**Total Est. Demand:**	14 A

Notes:

Branch Panel: 3PB2

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC310 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Receptacle CLASSROOM SC308 FLOORBOX	1	20 A	1	1800 VA	200 VA					1	20 A	4	Power SC308, SC316, SC318, SC320 TRAP PR.	2
3	Power CLASSROOM SC308	1	20 A	1			1000 VA	500 VA			1	20 A	1	Motor IDF SC307 CONDENSATE PUMP	4
5	Power SC301-7, SC301-6, SC301-5, ...CLOCKS	12	20 A	1					600 VA	150 VA	1	20 A	3	Power SC313, SC326, SC315 TRAP PRIMER	6
7	Power MECHANICAL EQUIPMENT	3	20 A	1	900 VA	0 VA					1	20 A	--	Spare	8
9	Power MECHANICAL EQUIPMENT	3	20 A	1			900 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	2900 VA		2400 VA		750 VA						
				Total Amps:	26 A		22 A		6 A						

3

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	3750 VA			**Total Conn. Load:**	6050 VA
Receptacle	1800 VA			**Total Est. Demand:**	6050 VA
Motor	500 VA			**Total Conn.:**	17 A
Other	0 VA			**Total Est. Demand:**	17 A

Notes:

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HGA
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
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SANTA ANA COLLEGE

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LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER No. E 20372 Exp. 09-30-18 ELECTRICAL STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 03 PANEL SCHEDULES

DATE: JULY 06, 2017

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Branch Panel: HMWR

SANTA ANA COLLEGE SCIENCE CENTER

Location: ROOF SC230 **Volts:** 480/277 Wye **A.I.C. Rating:**
Supply From: MHDB **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 400 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	AHU-1 S.F. (40 HP)	1	70 A	3	14000...	1000 VA					3	20 A	1	TEF-1 (3 HP)	2
3	--	--	--	--			14000...	1000 VA			--	--	--	--	4
5	--	--	--	--					14000...	1000 VA	--	--	--	--	6
7	AHU-2 S.F. (30 HP)	1	60 A	3	11000...	800 VA					3	20 A	1	EF-6 (1 1/2 HP)	8
9	--	--	--	--			11000...	800 VA			--	--	--	--	10
11	--	--	--	--					11000...	800 VA	--	--	--	--	12
13	AHU-3 S.F. (30 HP)	1	70 A	3	11000...	0 VA					1	20 A	--	Spare	14
15	--	--	--	--			11000...	0 VA			1	20 A	--	Spare	16
17	--	--	--	--					11000...	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	37800 VA		37800 VA		37800 VA						
				Total Amps:	136 A		136 A		136 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	113400 VA			**Total Conn. Load:**	113400 VA
Receptacle	0 VA			**Total Est. Demand:**	113400 VA
Motor	0 VA			**Total Conn.:**	136 A
Other	0 VA			**Total Est. Demand:**	136 A

Notes:

Branch Panel: EQM3

SANTA ANA COLLEGE SCIENCE CENTER

Location: ROOF SC230 **Volts:** 480/277 Wye **A.I.C. Rating:**
Supply From: EQHD1 **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 400 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	EF-1	1	50 A	3	2000 VA	2000 VA					3	50 A	1	EF-2	2
3	--	--	--	--			2000 VA	2000 VA			--	--	--	--	4
5	--	--	--	--					2000 VA	2000 VA	--	--	--	--	6
7	EF-3	1	50 A	3	2000 VA	2000 VA					3	50 A	1	EF-4	8
9	--	--	--	--			2000 VA	2000 VA			--	--	--	--	10
11	--	--	--	--					2000 VA	2000 VA	--	--	--	--	12
13	PAC-1	1	30 A	3	2000 VA	0 VA					1	20 A	--	Spare	14
15	--	--	--	--			2000 VA	0 VA			1	20 A	--	Spare	16
17	--	--	--	--					2000 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	10000 VA		10000 VA		10000 VA						
				Total Amps:	36 A		36 A		36 A						

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	30000 VA			**Total Conn. Load:**	30000 VA
Receptacle	0 VA			**Total Est. Demand:**	30000 VA
Motor	0 VA			**Total Conn.:**	36 A
Other	0 VA			**Total Est. Demand:**	36 A

Notes:

Branch Panel: ELM3

SANTA ANA COLLEGE SCIENCE CENTER

Location: ELEC. CLOSET SC324 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: EQPD1 **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Power ROOF SC322-3	1	20 A	1	1000 VA	2000 VA					3	50 A	1	CU-1 (1)	2
3	Power ROOF SC322-3	1	20 A	1			1000 VA	2000 VA			--	--	--	--	4
5	Power ROOF SC322-3	1	20 A	1					1000 VA	2000 VA	--	--	--	--	6
7	Power ROOF SC322-3	1	20 A	1	1000 VA	2000 VA					3	50 A	1	CU-1 (2)	8
9	Power ROOF SC230	1	20 A	1			1000 VA	2000 VA			--	--	--	--	10
11	Power ROOF SC230	1	20 A	1					1000 VA	2000 VA	--	--	--	--	12
13	Power ROOF SC230 MECH CONTROLLER	1	20 A	1	500 VA	0 VA					1	20 A	--	Spare	14
15	Power ROOF SC230 MECH CONTROLLER	1	20 A	1			500 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Provision	--	--	--	0 VA	0 VA					--	--	--	Provision	38
39	Provision	--	--	--			0 VA	0 VA			--	--	--	Provision	40
41	Provision	--	--	--					0 VA	0 VA	--	--	--	Provision	42
				Total Load:	6500 VA		6500 VA		6000 VA						
				Total Amps:	55 A		55 A		50 A						

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	19000 VA			**Total Conn. Load:**	19000 VA
Receptacle	0 VA			**Total Est. Demand:**	19000 VA
Motor	0 VA			**Total Conn.:**	53 A
Other	0 VA			**Total Est. Demand:**	53 A

Notes:

Branch Panel: LMWR

SANTA ANA COLLEGE SCIENCE CENTER

Location: ROOF SC230 **Volts:** 120/208 Wye **A.I.C. Rating:**
Supply From: PDBA **Phases:** 3 **Mains Type:**
Mounting: Surface **Wires:** 4 **Mains Rating:** 225 A
MCB Rating: 225 A

CKT	Circuit Description	Quan	Trip	Pole	A		B		C		Pole	Trip	Quan	Circuit Description	CKT
1	Power ROOF SC230 MECH CONTROLLER	1	20 A	1	500 VA	360 VA					1	20 A	2	Receptacle ROOF SC322-3	2
3	Power ROOF SC230 MECH CONTROLLER	1	20 A	1			500 VA	360 VA			1	20 A	2	Receptacle ROOF SC322-3	4
5	Spare	--	20 A	1					0 VA	1200 VA	1	20 A	1	BEF-1	6
7	Spare	--	20 A	1	0 VA	700 VA					1	20 A	1	BEF-2	8
9	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	10
11	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	12
13	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	14
15	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	16
17	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	18
19	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	20
21	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	22
23	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	24
25	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	26
27	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	28
29	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	30
31	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	32
33	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	34
35	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	36
37	Spare	--	20 A	1	0 VA	0 VA					1	20 A	--	Spare	38
39	Spare	--	20 A	1			0 VA	0 VA			1	20 A	--	Spare	40
41	Spare	--	20 A	1					0 VA	0 VA	1	20 A	--	Spare	42
				Total Load:	1560 VA		860 VA		1200 VA						
				Total Amps:	13 A		7 A		10 A						

3

Legend:

Load Classification	Connected Load			Panel Totals	
Lighting	0 VA				
Power	2900 VA			**Total Conn. Load:**	3620 VA
Receptacle	720 VA			**Total Est. Demand:**	3620 VA
Motor	0 VA			**Total Conn.:**	10 A
Other	0 VA			**Total Est. Demand:**	10 A

Notes:

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LICENSED ARCHITECT JAMES G. MATSON C13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA
REGISTERED PROFESSIONAL ENGINEER No. E 20372 Exp. 09-30-18 ELECTRICAL STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA REVIEW BY: R. Rogers

HGA NO: 3584-001-00

ROOF PANEL SCHEDULES

DATE: JULY 06, 2017

E0.7F

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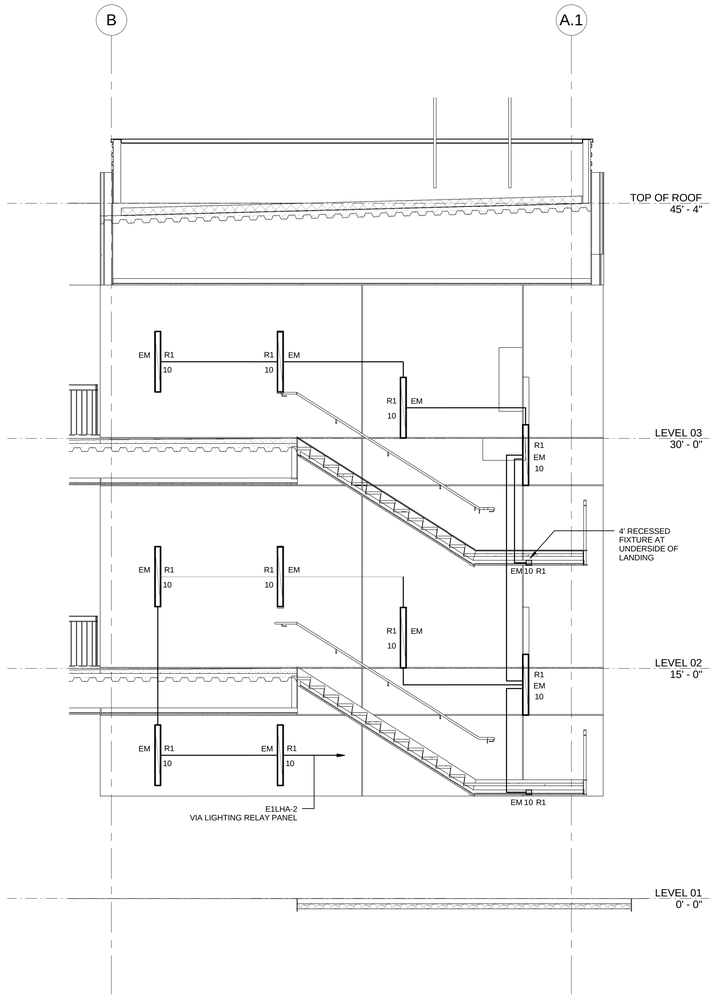
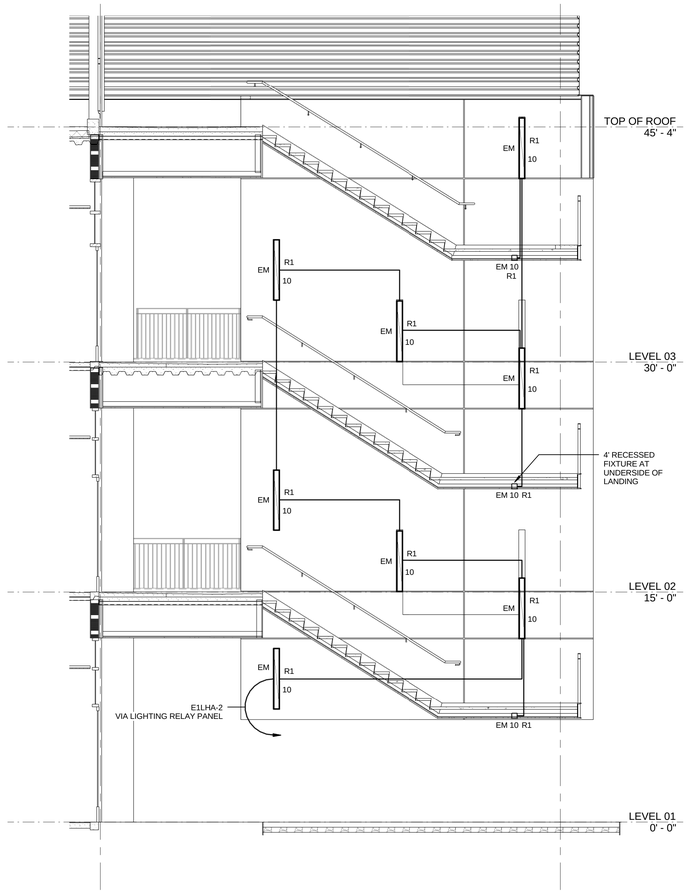
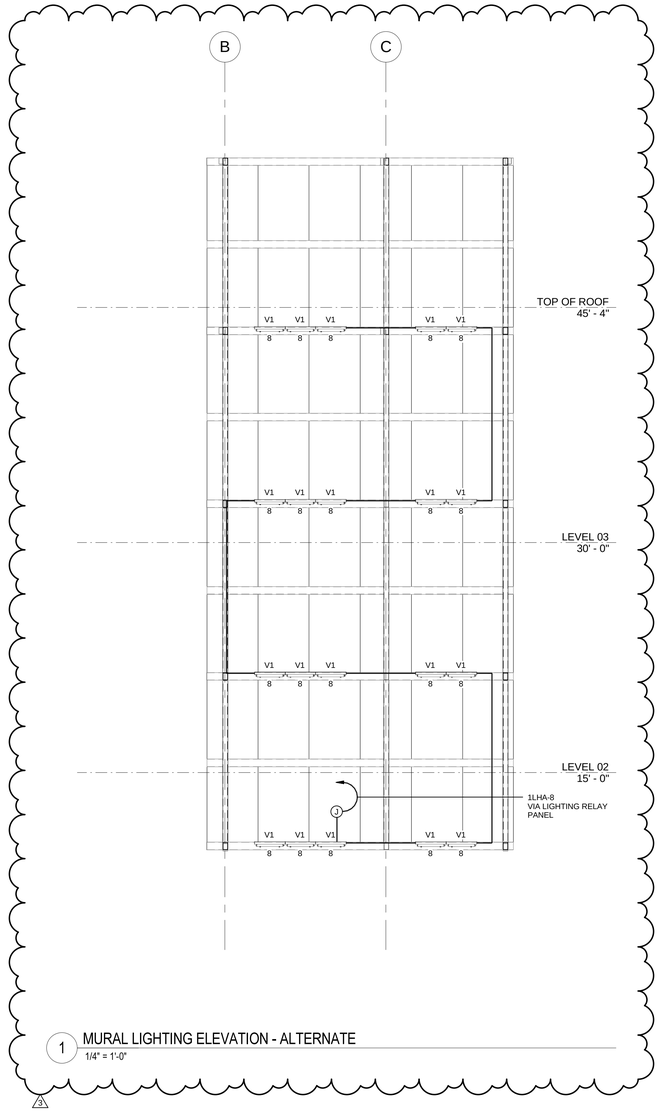


3 STAIR #2 LIGHTING PLAN
1/4" = 1'-0"



2 STAIR #1 LIGHTING PLAN
1/4" = 1'-0"



1 MURAL LIGHTING ELEVATION - ALTERNATE
1/4" = 1'-0"

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JAMES G. MATSON — No. C13036 — REGISTERED ARCHITECT — STATE OF CALIFORNIA — SEPTEMBER 30, 2017 — RENEWAL DATE

ELECTRICAL — No. E-13036 — 08-31-18 — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

MURAL AND STAIRWELL LIGHTING PLANS

DATE: JULY 06, 2017

E2.3

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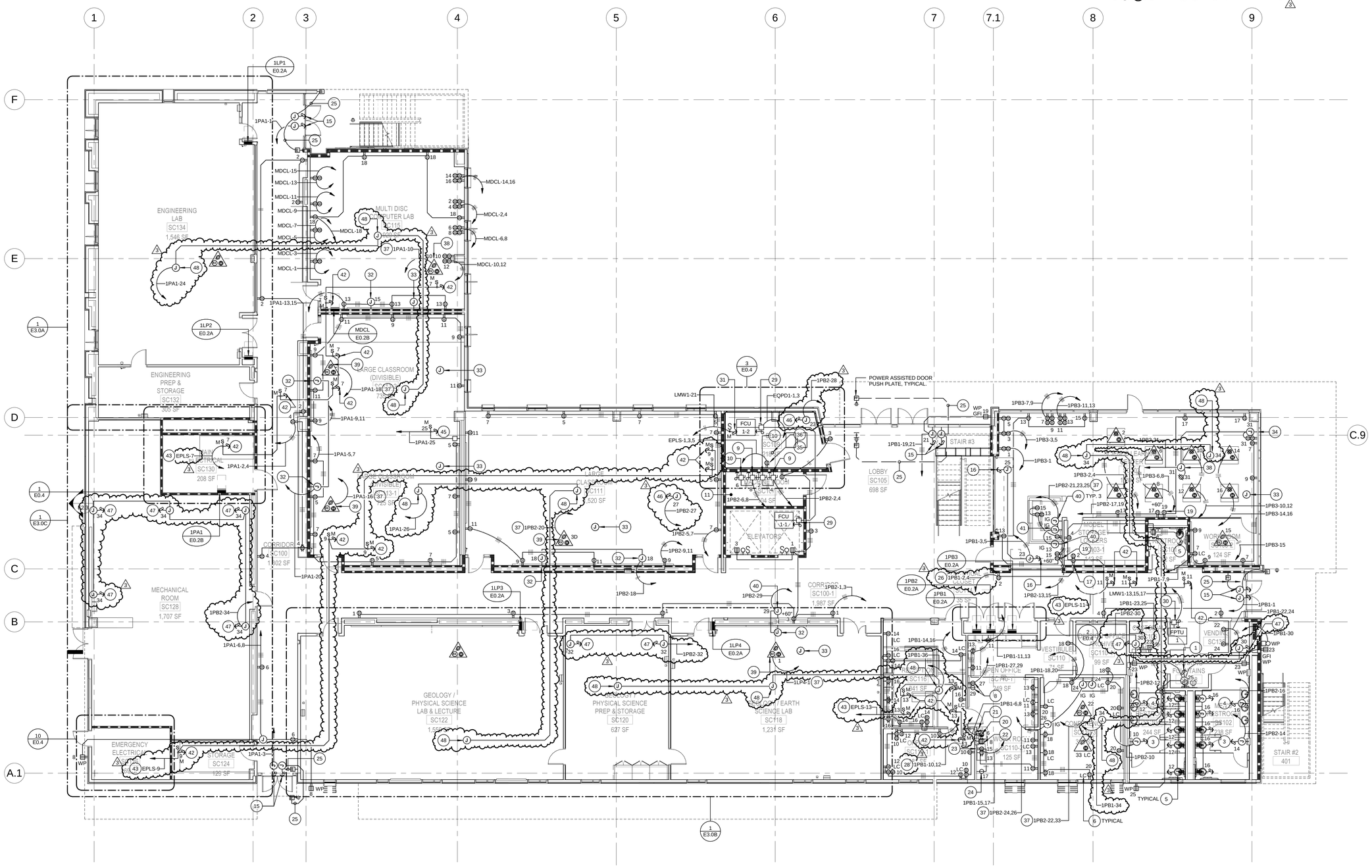
GENERAL NOTE:

1. UNLESS OTHERWISE NOTED, ALL CONDUIT SHALL BE ¾"C. – 2#12 AND 1#12 GROUND.
2. REFER TO TELECOM DRAWINGS FOR 120V. CLOCK CIRCUIT REQUIREMENTS. (3)



1 LEVEL 01 POWER PLAN
1/8" = 1'-0"

(40) J-BOX FOR VIDEO DISPLAY: FSR-INC PWB-253 WITH REQUIRED ACCESSORIES AND COVER., WALL MOUNTED. PROVIDE ONE DUPLEX RECEPTACLE. COORDINATE LOCATION WITH AV CONTRACTOR.

(41) J-BOX VIDEO DISPLAY: FSR-INC PWB-253 WITH REQUIRED ACCESSORIES AND COVER, WALL MOUNTED. PROVIDE ONE DUPLEX RECEPTACLE WITH ISOLATED GROUND (SEE DETAIL ON AV0.02P). COORDINATE LOCATION WITH AV CONTRACTOR.

(42) PROVIDE CONNECTION TO SMOKE FIRE DAMPERS AS REQUIRED. VERIFY EXACT LOCATION WITH MECHANICAL DRAWINGS PRIOR TO ROUGH-IN.

(43) ROUTE CIRCUIT THROUGH FIRE ALARM RELAY MODULE ABOVE PANEL "EPLS" AS REQUIRED.

(44) NOT USED. (3)

(45) PROVIDE CONNECTION TO MOTORIZED PARTITION PER MANUFACTURER'S REQUIREMENTS. (3)

(46) FOR CONNECTION TO CONDENSATE PUMP.

(47) FOR CONNECTION TO TRAP PRIMER.

(48) J-BOX FOR CONNECTION TO MECHANICAL DEVICES IN THIS AREA. REFER TO MECHANICAL DRAWINGS FOR EXACT QUANTITY AND LOCATIONS.

(31) FOR CDP-1: PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL. RUN 3/4"C - 1#12 & 1#12 - G TO DISCONNECT SWITCH FOR CDP-1 ON 2ND FLOOR.

(32) J-BOX FOR VIDEO PROJECTOR: 4.7" SQUARE BOX DEEP W/2GMR MOUNTED AT 8'-6" AFF WITH ONE DUPLEX RECEPTACLE. COORDINATE LOCATION WITH AV CONTRACTOR.

(33) J-BOX FOR AV DISTRIBUTION: HOFFMAN ASG 12X12X6 WITH COVER ABOVE CEILING. COORDINATE LOCATION WITH AV CONTRACTOR.

(34) J-BOX FOR PROJECTION SCREEN: 4.7" SQUARE BOX DEEP W/2GMR MOUNTED IN CEILING SPACE WITH ONE DUPLEX RECEPTACLE. COORDINATE LOCATION WITH AV CONTRACTOR.

(35) FOR SECURITY ACCESS CONTROL PANEL. VERIFY EXACT LOCATION WITH SECURITY CONTRACTOR.

(36) 3/4"C - 4#12 & 1#10 - G UP TO RECEPTACLE FOR SECURITY ACCESS CONTROL PANEL ON SECOND FLOOR.

(37) PROVIDE ISOLATED GROUND WIRE. SEE DETAILS ON AV0.02P.

(38) J-BOX FOR VIDEO PROJECTOR: 4.7" SQUARE BOX DEEP W/2GMR MOUNTED IN CEILING SPACE WITH ONE DUPLEX RECEPTACLE WITH ISOLATED GROUND (SEE DETAIL ON AV0.02P). COORDINATE LOCATION WITH AV CONTRACTOR.

(39) FOR LECTERN. VERIFY EXACT LOCATION WITH ARCHITECT.

(19) FOR CONNECTION TO DIGITAL DISPLAY.

(20) FOR CONNECTION TO DISPOSAL.

(21) ENGRAVE SWITCH CONFIGURE TO READ: "DISPOSAL".

(22) FOR CONNECTION TO COFFEE MAKER.

(23) FOR CONNECTION TO MICROWAVE OVEN. REFER TO ARCHITECTURAL INTERIOR ELEVATIONS FOR MOUNTING HEIGHT.

(24) FOR CONNECTION TO REFRIGERATOR.

(25) PROVIDE 3/4"C. WITH CONTROLLED WIRING IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS.

(26) PROVIDE 4#12, 1#12 GRD. - 3/4"C. TO IPBI – 2, 4.

(27) PROVIDE 4#12, 1#12 GRD. - 3/4"C. TO IPBI – 6, 8.

(28) PROVIDE 4#12, 1#12 GRD. - 3/4"C. TO IPBI – 10, 12.

(29) PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL.

(30) FOR FPTU-1: PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL. RUN 3/4"C - 3#12 & 1#12 - G TO DISCONNECT SWITCH FOR FPTU-2 ON 2ND FLOOR (SEE NOTE 13/E3.1).

(8) FOR CONNECTION TO COPIER.

(9) CONNECTION TO ELEVATOR CONTROLLER IN ACCORDANCE WITH THE ELEVATOR MANUFACTURER'S REQUIREMENTS.

(10) CONNECTION TO ELEVATOR CAB LIGHTS, EF, CONV. RECEPTACLES, ETC. IN ACCORDANCE WITH THE ELEVATOR MANUFACTURER'S REQUIREMENTS.

(11) INSTALL ALL ELECTRICAL DEVICES IN THE ELEVATOR MACHINE ROOM IN LOCATIONS PER THE ELEVATOR MANUFACTURER'S INSTALLATION REQUIREMENTS. (3)

(12) NOT USED.

(13) NOT USED.

(14) FOR CONNECTION TO VENDING MACHINES.

(15) CONNECT TO POWER ASSISTED DOOR IN ACCORDANCE WITH THE DOOR MANUFACTURER'S REQUIREMENTS.

(16) CONNECT TO OVERHEAD COILING DOOR IN ACCORDANCE WITH THE DOOR MANUFACTURER'S REQUIREMENTS.

(17) FOR CONNECTION TO LAPTOP CART.

(18) NOT USED. (3)

PLAN NOTES:

(1) CONNECT TO ELECTRIC WATER COOLER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S REQUIREMENTS.

(2) FOR CONNECTION TO REFRIGERATOR, +36".

(3) CONNECT TO THE HAND DRYER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S REQUIREMENTS. VERIFY THE MOUNTING HEIGHT WITH THE ARCHITECTURAL INTERIOR ELEVATIONS.

(4) CONNECT TO AUTOMATIC LAV TRANSFORMER/POWER SUPPLIES. TRANSFORMER/POWER SUPPLIES SHALL BE MOUNTED IN A LOCKING STAINLESS STEEL ENCLOSURE MOUNTED UNDER THE LAV'S. PROVIDE CONTROL WIRING AND CONNECTIONS TO THE SENSOR OPERATED FAUCETS IN ACCORDANCE WITH THE FAUCET MANUFACTURER'S REQUIREMENTS.

(5) CONNECT TO AUTOMATIC URINAL AND WATER CLOSET TRANSFORMER/POWER SUPPLIES. TRANSFORMER/POWER SUPPLIES SHALL BE MOUNTED IN A LOCKING STAINLESS STEEL ENCLOSURE MOUNTED AT THE URINALS AND WATER CLOSETS. PROVIDE CONTROL WIRING AND CONNECTIONS TO THE FLUSH VALVES IN ACCORDANCE WITH THE FLUSH VALVE MANUFACTURER'S REQUIREMENTS.

(6) INDICATES PROVIDE SPLIT WIRED DUPLEX RECEPTACLE CONTROLLED BY THE RESPECTIVE ROOMS LIGHTING CONTROLS IN ACCORDANCE WITH THE 2013 CEC TITLE 24 SECTION 130.1(C). TYPICAL FOR ALL RECEPTACLES IN PRIVATE OFFICES, OPEN OFFICE AREAS, RECEPTION, LOBBY, CONFERENCE ROOMS, KITCHENETTES AND COPY ROOMS. RECEPTACLES SHALL BE GREEN IN COLOR.

(7) NOT USED. (3)

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 01 POWER PLAN

DATE: JULY 06, 2017

E3.0

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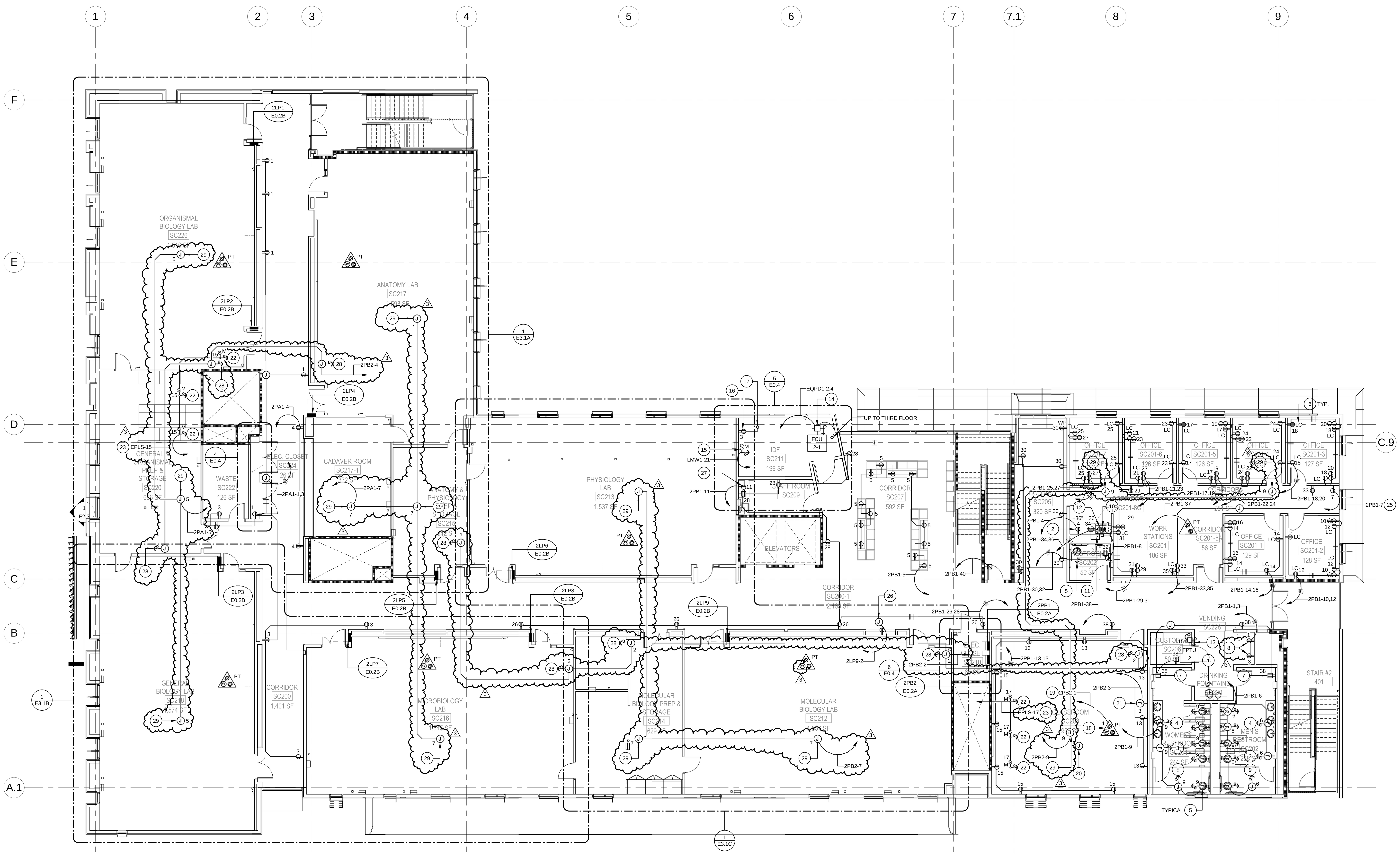

1 LEVEL 02 POWER PLAN

1/8" = 1'-0"

GENERAL NOTE:

1. UNLESS OTHERWISE NOTED, ALL CONDUIT SHALL BE ¾"C. – 2#12 AND 1#12 GROUND.
2. REFER TO TELECOM DRAWINGS FOR 120V. CLOCK CIRCUIT REQUIREMENTS.

(29) J-BOX FOR CONNECTION TO MECHANICAL DEVICES IN THIS AREA. REFER TO MECHANICAL DRAWINGS FOR EXACT QUANTITY AND LOCATIONS.

(18) FOR LECTERN. VERIFY EXACT LOCATION WITH ARCHITECT.

(19) PROVIDE ISOLATED GROUND WIRE. SEE DETAILS ON AV0.02P.

(20) J-BOX FOR AV DISTRIBUTION: HOFFMAN ASG 12X12X6 WITH COVER ABOVE CEILING. COORDINATE LOCATION WITH AV CONTRACTOR.

(21) J-BOX FOR VIDEO PROJECTOR" 4.7" SQUARE BOX DEEP W/2GMR MOUNTED AT 8'-6" AFF WITH ONE DUPLEX RECEPTACLE. COORDINATE LOCATION WITH AV CONTRACTOR.

(22) PROVIDE CONNECTION TO SMOKE FIRE DAMPERS AS REQUIRED. VERIFY EXACT LOCATION WITH MECHANICAL DRAWINGS PRIOR TO ROUGH-IN.

(23) ROUTE CIRCUIT THROUGH FIRE ALARM RELAY MODULE ABOVE PANEL "EPLS" AS REQUIRED.

(24) NOT USED.

(25) FOR CONNECTION TO PRINTER.

(26) J-BOX FOR VIDEO DISPLAY: FSR-INC PWB-253 WITH REQUIRED ACCESSORIES AND COVER., WALL MOUNTED. PROVIDE ONE DUPLEX RECEPTACLE. COORDINATE LOCATION WITH AV CONTRACTOR.

(27) FOR CONNECTION TO REFRIGERATOR.

(28) FOR CONNECTION TO TRAP PRIMER.

(8) FOR CONNECTION TO VENDING MACHINES.

(9) CONNECT TO TWO PANEL

(10) FOR CONNECTION TO DISPOSAL.

(11) ENGRAVE SWITCH CONFIGURE TO READ: "DISPOSAL".

(12) FOR CONNECTION TO MICROWAVE OVEN.

(13) FOR FTPU-2: PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL. RUN 3/4"C - 2#12 & 1#12 - G TO DISCONNECT SWITCH FOR FPTU-3 ON 2ND FLOOR (SEE NOTE 13/E3.1).

(14) PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL.

(15) FOR CDP-1: PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURERE'S REQUIRMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL. RUN 3/4"C - 1#12 & 1#12 - G TO DISCONNECT SWITCH FOR CDP-1 ON 3RD FLOOR. SEE NOTE 31/E-3.0.

(16) FOR SECURITY ACCESS CONTROL PANEL. VERIFY EXACT LOCATION WITH SECURITY CONTRACTOR.

(17) 3/4"C - 4#12 & 1#10 - G UP TO RECEPTACLE FOR SECURITY ACCESS CONTROL PANEL ON THIRD FLOOR. SEE NOTE 35/E3.0.

PLAN NOTES:

(1) CONNECT TO ELECTRIC WATER COOLER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S REQUIREMENTS.

(2) FOR CONNECTION TO REFRIGERATOR, +36".

(3) CONNECT TO THE HAND DRYER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S REQUIREMENTS. VERIFY THE MOUNTING HEIGHT WITH THE ARCHITECTURAL INTERIOR ELEVATIONS.

(4) CONNECT TO AUTOMATIC LAV TRANSFORMER/POWER SUPPLIES. TRANSFORMER/POWER SUPPLIES SHALL BE MOUNTED IN A LOCKING STAINLESS STEEL ENCLOSURE MOUNTED UNDER THE LAV'S. PROVIDE CONTROL WIRING AND CONNECTIONS TO THE SENSOR OPERATED FAUCETS IN ACCORDANCE WITH THE FAUCET MANUFACTURER'S REQUIREMENTS.

(5) CONNECT TO AUTOMATIC URINAL AND WATER CLOSET TRANSFORMER/POWER SUPPLIES. TRANSFORMER/POWER SUPPLIES SHALL BE MOUNTED IN A LOCKING STAINLESS STEEL ENCLOSURE MOUNTED AT THE URINALS AND WATER CLOSETS. PROVIDE CONTROL WIRING AND CONNECTIONS TO THE FLUSH VALVES IN ACCORDANCE WITH THE FLUSH VALVE MANUFACTURER'S REQUIREMENTS.

(6) PROVIDE SPLIT WIRED DUPLEX RECEPTACLE CONTROLLED BY THE RESPECTIVE ROOMS LIGHTING CONTROLS IN ACCORDANCE WITH THE 2013 CEC TITLE 24 SECTION 130.1(C). TYPICAL FOR ALL RECEPTACLES IN PRIVATE OFFICES, OPEN OFFICE AREAS, RECEPTION LOBBY, CONFERENCE ROOMS, KITCHENETTES AND COPY ROOMS. RECEPTACLES SHALL BE GREEN IN COLOR.

(7) MOUNT GFCI RECEPTACLE AT +6'-0"A.F.F.

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 02 POWER PLAN

DATE: JULY 06, 2017

E3.1

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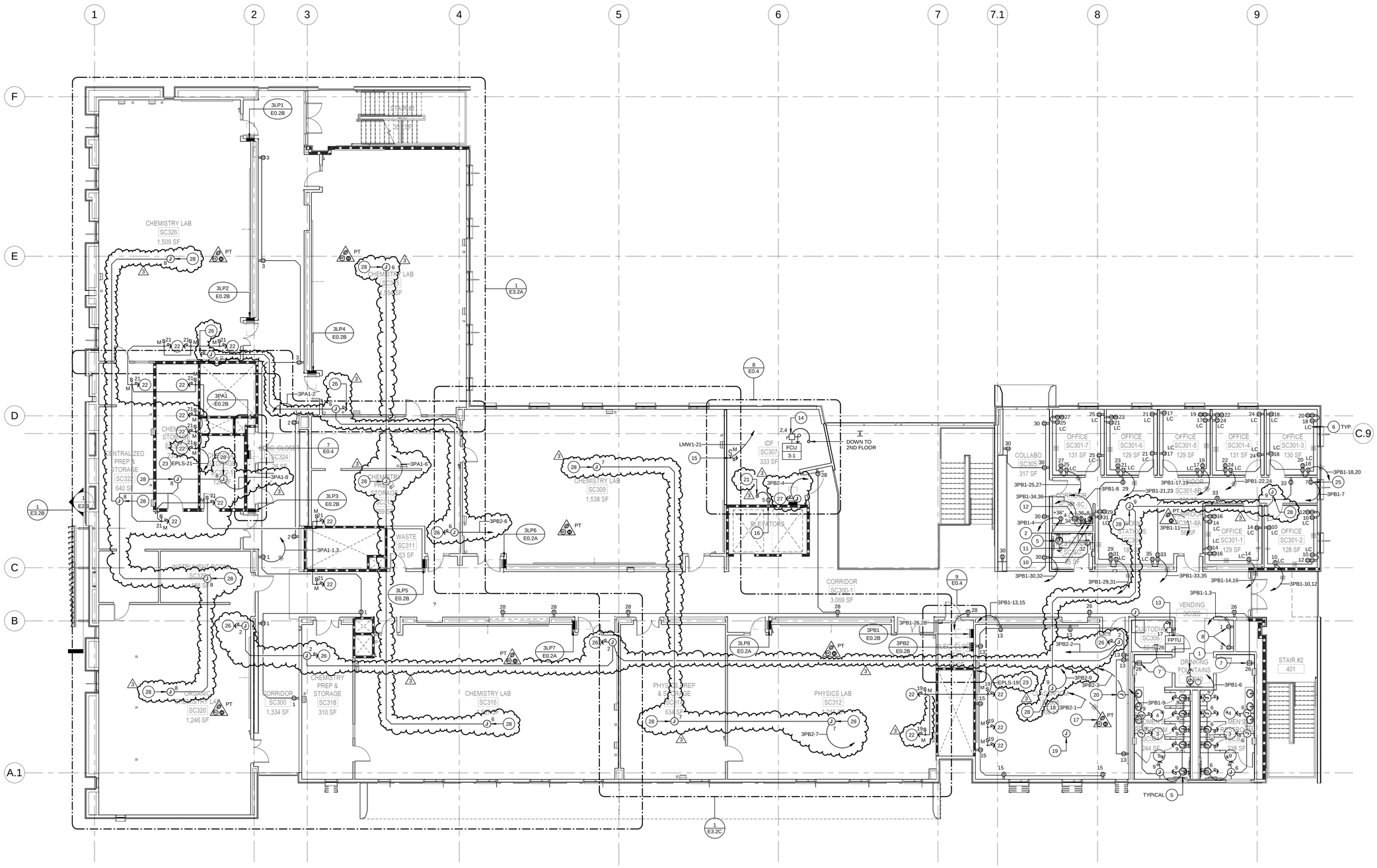

1 LEVEL 03 POWER PLAN
1/8" = 1'-0"

GENERAL NOTE:

1. UNLESS OTHERWISE NOTED, ALL CONDUIT SHALL BE ¾"C. – 2#12 AND 1#12 GROUND.
2. REFER TO TELECOM DRAWINGS FOR 120V. CLOCK CIRCUIT REQUIREMENTS. (3)

19. J-BOX FOR AV DISTRIBUTION: HOFFMAN ASG 12X12X6 WITH COVER ABOVE CEILING. COORDINATE LOCATION WITH AV CONTRACTOR.
20. J-BOX FOR VIDEO PROJECTOR: 4.7" SQUARE BOX DEEP W/2GMR MOUNTED AT 8'-6" AFF WITH ONE DUPLEX RECEPTACLE. COORDINATE LOCATION WITH AV CONTRACTOR.
21. 3/4"C - 4#12 & 1#10 - G DOWN TO RECEPTACLE FOR SECURITY ACCESS CONTROL PANEL ON SECOND FLOOR. SEE NOTE 17/E3.1.
22. PROVIDE CONNECTION TO SMOKE FIRE DAMPERS AS REQUIRED. VERIFY EXACT LOCATION WITH MECHANICAL DRAWINGS PRIOR TO ROUGH-IN.
23. ROUTE CIRCUIT THROUGH FIRE ALARM RELAY MODULE ABOVE PANEL "EPLS" AS REQUIRED. (3)
24. NOT USED. (3)
25. FOR CONNECTION TO PRINTER.
26. FOR CONNECTION TO TRAP PRIMER.
27. FOR CONNECTION TO CONDENSATE PUMP. (4)
28. J-BOX FOR CONNECTION TO MECHANICAL DEVICES IN THIS AREA. REFER TO MECHANICAL DRAWINGS FOR EXACT QUANTITY AND LOCATIONS.

8. FOR CONNECTION TO VENDING MACHINES.
9. CONNECT TO TRAP FRAMER. REFER TO PLUMBING DRAWING FOR LOCATION.
10. FOR CONNECTION TO DISPOSAL.
11. ENGRAVE SWITCH CONFIGURE TO READ: "DISPOSAL".
12. FOR CONNECTION TO MICROWAVE OVEN.
13. FOR FPTU-3: PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL. SEE NOTE 13/E3.1.
14. PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL.
15. FOR CDP-1: PROVIDE FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER MANUFACTURER'S REQUIREMENTS. COORDINATE MOUNTING LOCATION WITH MECHANICAL. SEE NOTE 31/E-3.0.
16. FOR SECURITY ACCESS CONTROL PANEL. VERIFY EXACT LOCATION WITH SECURITY CONTRACTOR.
17. FOR LECTERN. VERIFY EXACT LOCATION WITH ARCHITECT.
18. PROVIDE ISOLATED GROUND WIRE. SEE DETAILS ON AV0.02P.

PLAN NOTES:

1. CONNECT TO ELECTRIC WATER COOLER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S REQUIREMENTS.
2. FOR CONNECTION TO REFRIGERATOR, +36".
3. CONNECT TO THE HAND DRYER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S REQUIREMENTS. VERIFY THE MOUNTING HEIGHT WITH THE ARCHITECTURAL INTERIOR ELEVATIONS.
4. CONNECT TO AUTOMATIC LAV TRANSFORMER/POWER SUPPLIES. TRANSFORMER/POWER SUPPLIES SHALL BE MOUNTED IN A LOCKING STAINLESS STEEL ENCLOSURE MOUNTED UNDER THE LAV'S. PROVIDE CONTROL WIRING AND CONNECTIONS TO THE SENSOR OPERATED FAUCETS IN ACCORDANCE WITH THE FAUCET MANUFACTURER'S REQUIREMENTS.
5. CONNECT TO AUTOMATIC URINAL AND WATER CLOSET TRANSFORMER/POWER SUPPLIES. TRANSFORMER/POWER SUPPLIES SHALL BE MOUNTED IN A LOCKING STAINLESS STEEL ENCLOSURE MOUNTED AT THE URINALS AND WATER CLOSETS. PROVIDE CONTROL WIRING AND CONNECTIONS TO THE FLUSH VALVES IN ACCORDANCE WITH THE FLUSH VALVE MANUFACTURER'S REQUIREMENTS.
6. PROVIDE SPLIT WIRED DUPLEX RECEPTACLE CONTROLLED BY THE RESPECTIVE ROOMS LIGHTING CONTROLS IN ACCORDANCE WITH THE 2013 CEC TITLE 24 SECTION 130.1(C). TYPICAL FOR ALL RECEPTACLES IN PRIVATE OFFICES, OPEN OFFICE AREAS, RECEPTION LOBBY, CONFERENCE ROOMS, KITCHENETTES AND COPY ROOMS. RECEPTACLES SHALL BE GREEN IN COLOR.
7. MOUNT GFCI RECEPTACLE AT +6'-0" A.F.F.

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 03 POWER PLAN

DATE: JULY 06, 2017

E3.2

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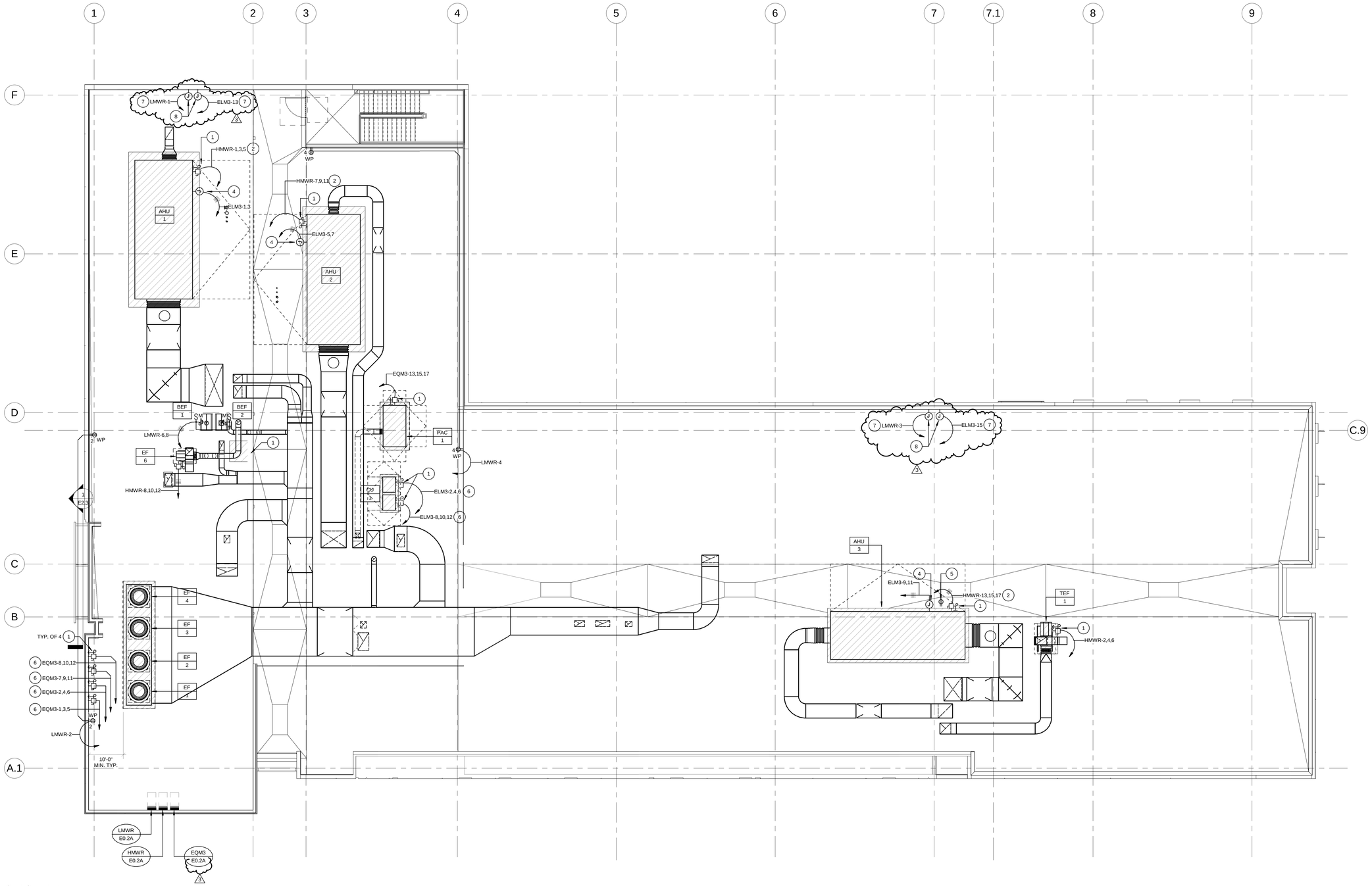

1 ROOF ELECTRICAL PLAN
1/8" = 1'-0"

PLAN NOTES:

1. PROVIDE WEATHERPROOF FUSED DISCONNECT SWITCH AND CONNECT TO EQUIPMENT AS PER EQUIPMENT MANUFACTURER'S REQUIREMENT. COORDINATE MOUNTING LOCATION AND MOUNTING REQUIREMENTS WITH MECHANICAL.
2. 1 1/4"C.-3#2 & 1#8 GRD.
3. 1 1/4"C.-3#4 & 1#10 GRD.
4. AHU CONTROL PANEL. MAKE CONNECTIONS TO AHU CONTROL PANEL, LIGHT FIXTURES AND OTHER DEVICES AS PER AHU MANUFACTURER'S REQUIREMENTS.
5. MOUNT WP GFI RECEPTACLE ON UNISTRUT AT 18" AFF. COORDINATE LOCATION WITH MECHANICAL.
6. 1"C - 3#6 & 1#10 - GROUND.
7. 3/4"C - 2#10 & 1#10 - GROUND.
8. J-BOX FOR MECHANICAL CONTROLS. REFER TO MECHANICAL DRAWINGS FOR EXACT LOCATION & QUANTITY.

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DATE: MAY 16, 2017
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3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

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ROOF ELECTRICAL PLAN

DATE: JULY 06, 2017

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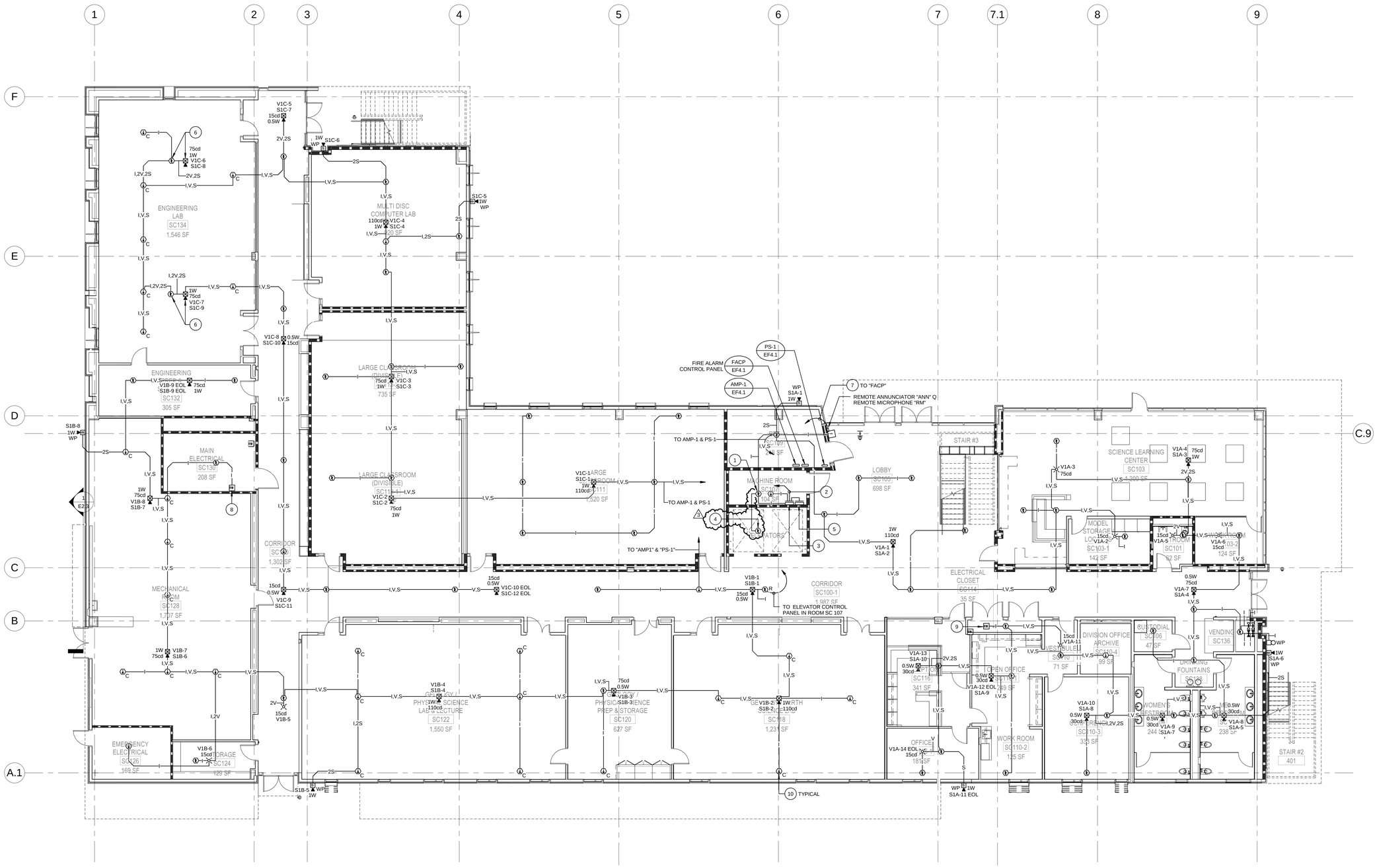

1 LEVEL 01 FIRE ALARM PLAN
1/8" = 1'-0"

PLAN NOTES:

1. DETECTORS SHALL NOT EXCEED 2 FEET FROM SPRINKLER HEAD.
2. PROVIDE 2#12 - 3/4"C. TO SHUNT TRIP MECHANISM AT PANEL "IPB2-2,4,6,8".
3. ELEVATOR CONTROL PANEL. VERIFY EXACT LOCATION WITH THE ELEVATOR SHOP DRAWINGS.
4. MOUNT DETECTOR IN ELEVATOR SHAFT. LOCATE IN ACCESSIBLE LOCATION FOR MAINTENANCE AT THIRD FLOOR.
5. ELEVATOR PIT ALARM PANEL. VERIFY EXACT LOCATION.
6. MOUNT FIRE ALARM DEVICE ON ACOUSTICAL CLOUD.
7. PROVIDE FIRE ALARM WIRING PER MANUFACTURER'S REQUIREMENT IN 1"C.
8. RELAY MODULE FOR CONTROL OF 120V CIRCUIT "1PA1-22" SERVING SMOKE FIRE DAMPAERS.WALL MOUNTED ABOVE PANEL "3PA1".
9. RELAY MODULE FOR CONTROL OF 120V CIRCUIT "1PB1-28" SERVING SMOKE FIRE DAMPERS. WALL MOUNTED ABOVE PANEL "1PB1".
10. MOUNT DETECTOR AT SHADED AREA NOT NEAR THE WINDOW TO AVOID DIRECT SUNLIGHT.

FIRE ALARM CONDUIT SCHEDULE

SYMBOL	CONDUCTORS (BELDEN 5020U2 OR EQUAL)	SIZE
—— I ——	2#16 UNSHIELDED TWISTED-PAIR INITIATING CIRCUIT	3/4"C.
—— V ——	2#12 THWN CU. VISUAL CIRCUIT	3/4"C.
—— S ——	2#18 SHIELDED TWISTED-PAIR SPEAKER CIRCUIT	3/4"C.
—— 2V ——	4#12 THWN CU. VISUAL CIRCUIT	3/4"C.
—— 2S ——	4#18 SHIELDED TWISTED-PAIR SPEAKER CIRCUIT	3/4"C.
—— I,2V,2S ——	MULTIPLE CONDUCTORS SHALL BE SHARED	1"C.

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ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

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LEVEL 01 FIRE ALARM PLAN

DATE: JULY 06, 2017

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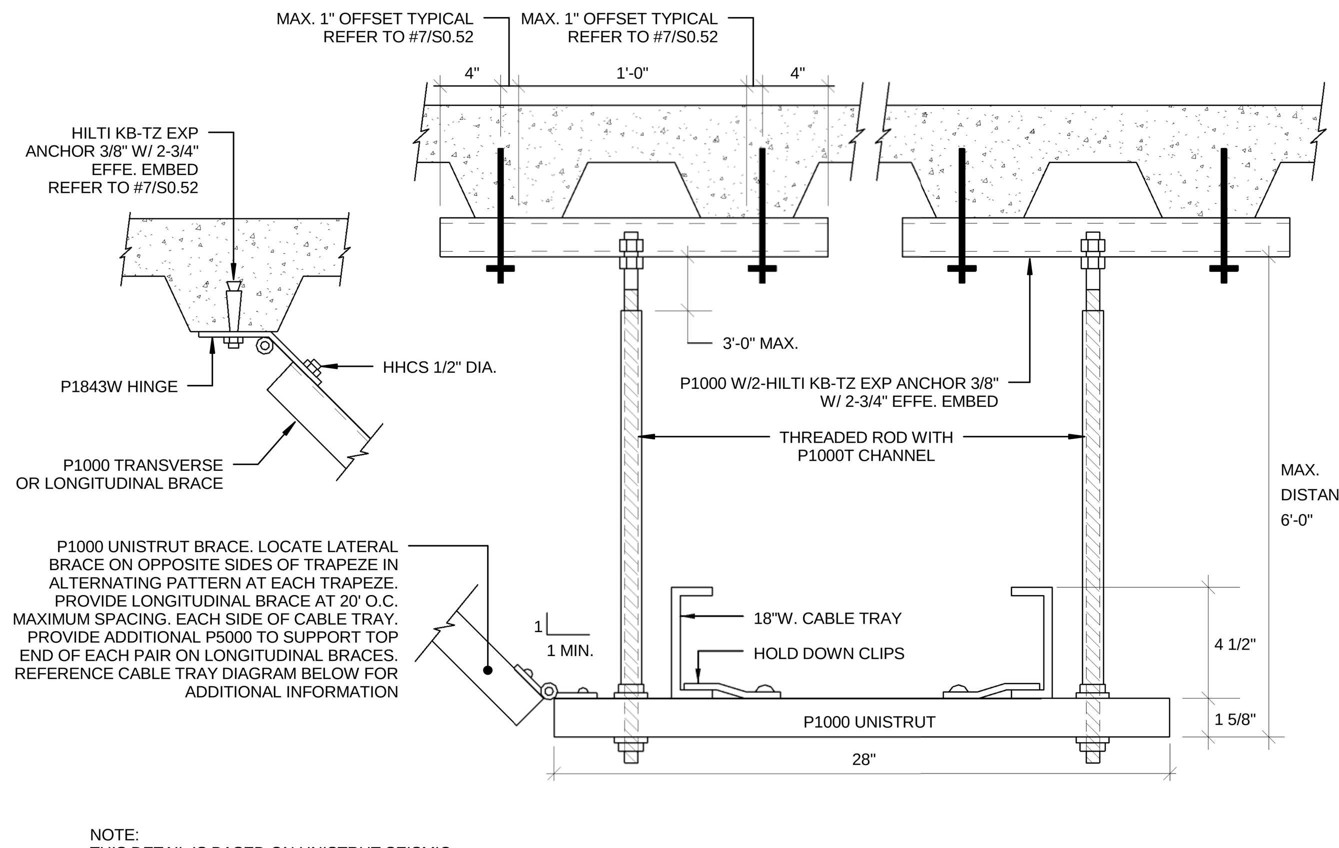
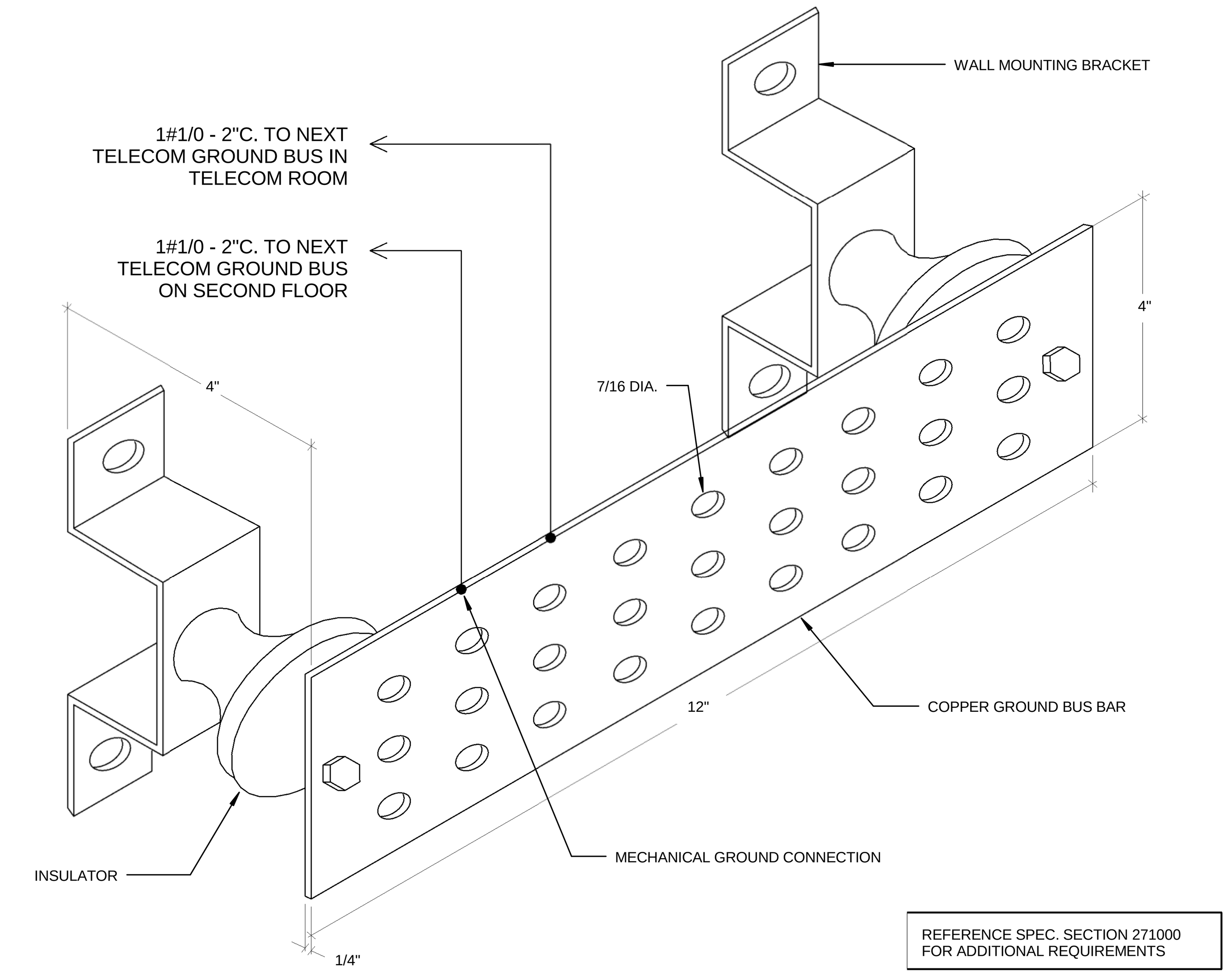


NOTE:
THIS DETAIL IS BASED ON UNISTRUT SEISMIC BRACING SYSTEMS OSHPD PREAPPROVED DETAILS
MAXIMUM DESIGN WEIGHT 86 LBS./LIN. FT.
TRAPEZE SPACING 10'-0" O.C. MAX.

CABLE TRAY ANCHORAGE DETAIL
SCALE N.T.S. — 4



REFERENCE SPEC. SECTION 271000
FOR ADDITIONAL REQUIREMENTS

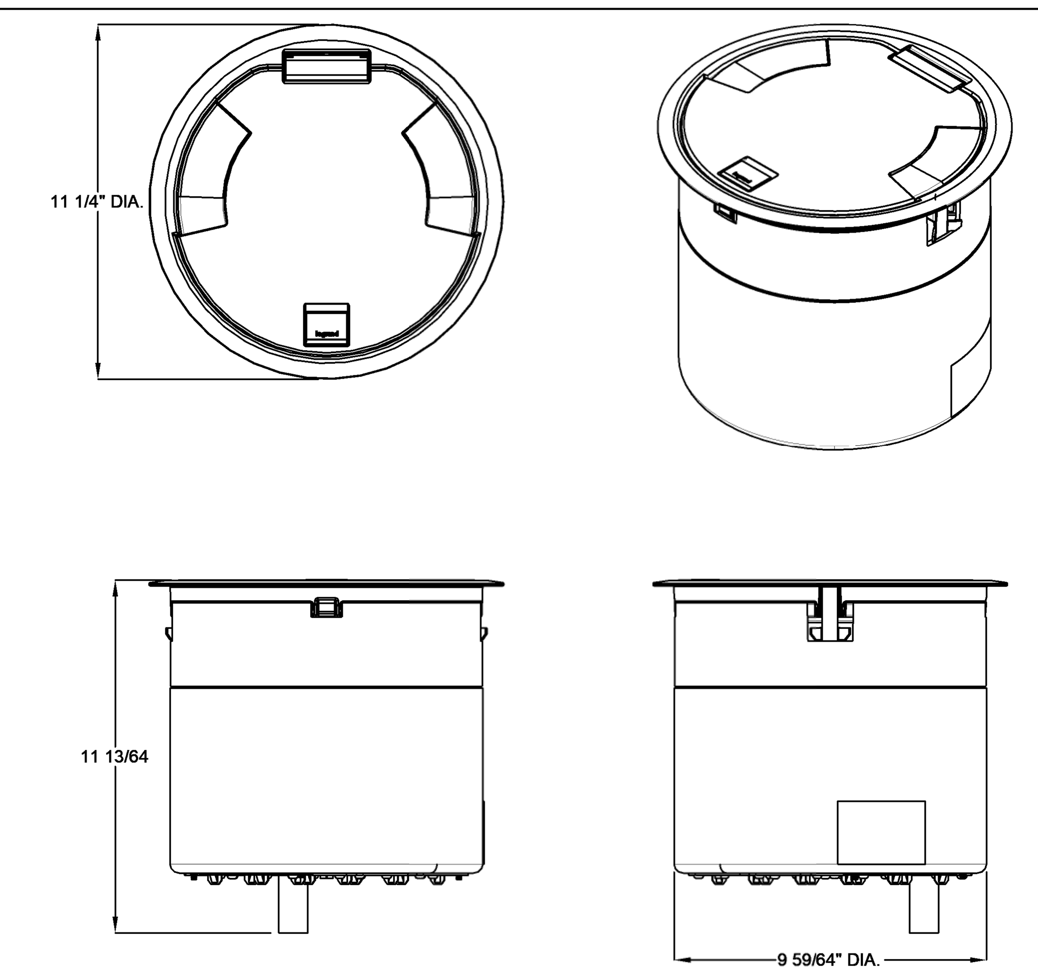
TECHNICAL GROUND BUS - BDF
SCALE N.T.S. — 2

SPECIAL PERFORMANCE NOTES

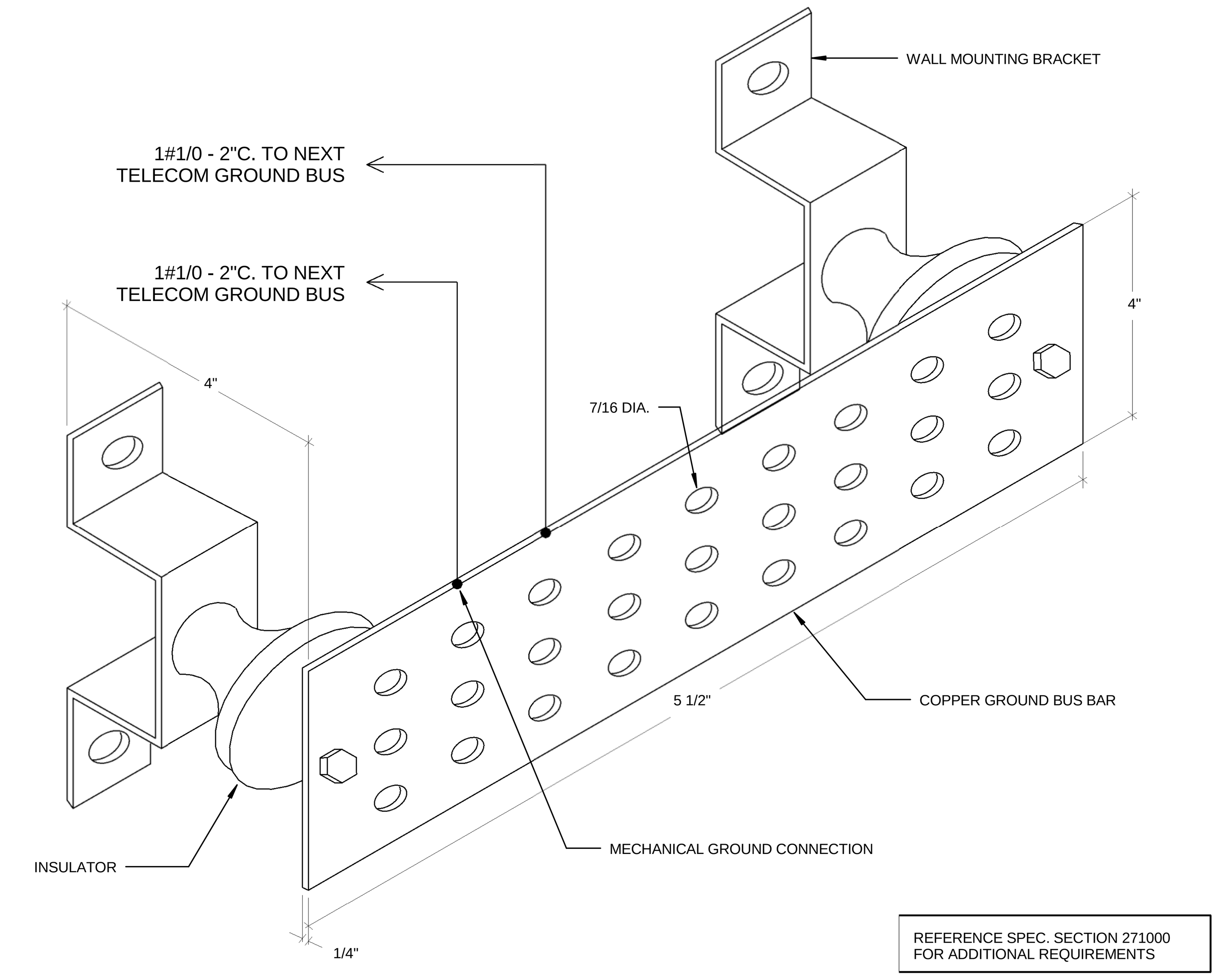
1. REFER TO AUDIO/VIDEO (AV) SERIES CONTRACT DOCUMENTS AND DRAWINGS FOR LOCATIONS OF ALL OUTLET BOXES, JUNCTION BOXES, FLOOR BOXES AND POINT-TO-POINT CONDUIT, RACEWAYS AND CABLING REQUIREMENTS. PROVIDE ALL POWER CONNECTIONS, RECEPTACLE CONDUIT, WIRING, GROUNDING, ETC. IN ACCORDANCE WITH THE REQUIREMENTS OF THE AV DRAWINGS. INCLUDE ALL ITEMS FOR A COMPLETE INSTALLATION.

2. REFER TO SECURITY/ACCESS CONTROLS AND DOOR HARDWARE CONTRACT DOCUMENTS AND DRAWINGS FOR ALL REQUIRED POWER AND SIGNAL SYSTEMS CONNECTIONS AND CONDUIT REQUIREMENTS. COORDINATION REQUIREMENTS WITH THE SECURITY AND DOOR HARDWARE INSTALLERS. INCLUDE ALL ITEMS FOR A COMPLETE SYSTEM.

3. REFER TO ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR CASEWORK LOCATIONS AND INSTALL ALL RECEPTACLES AND 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. (3)

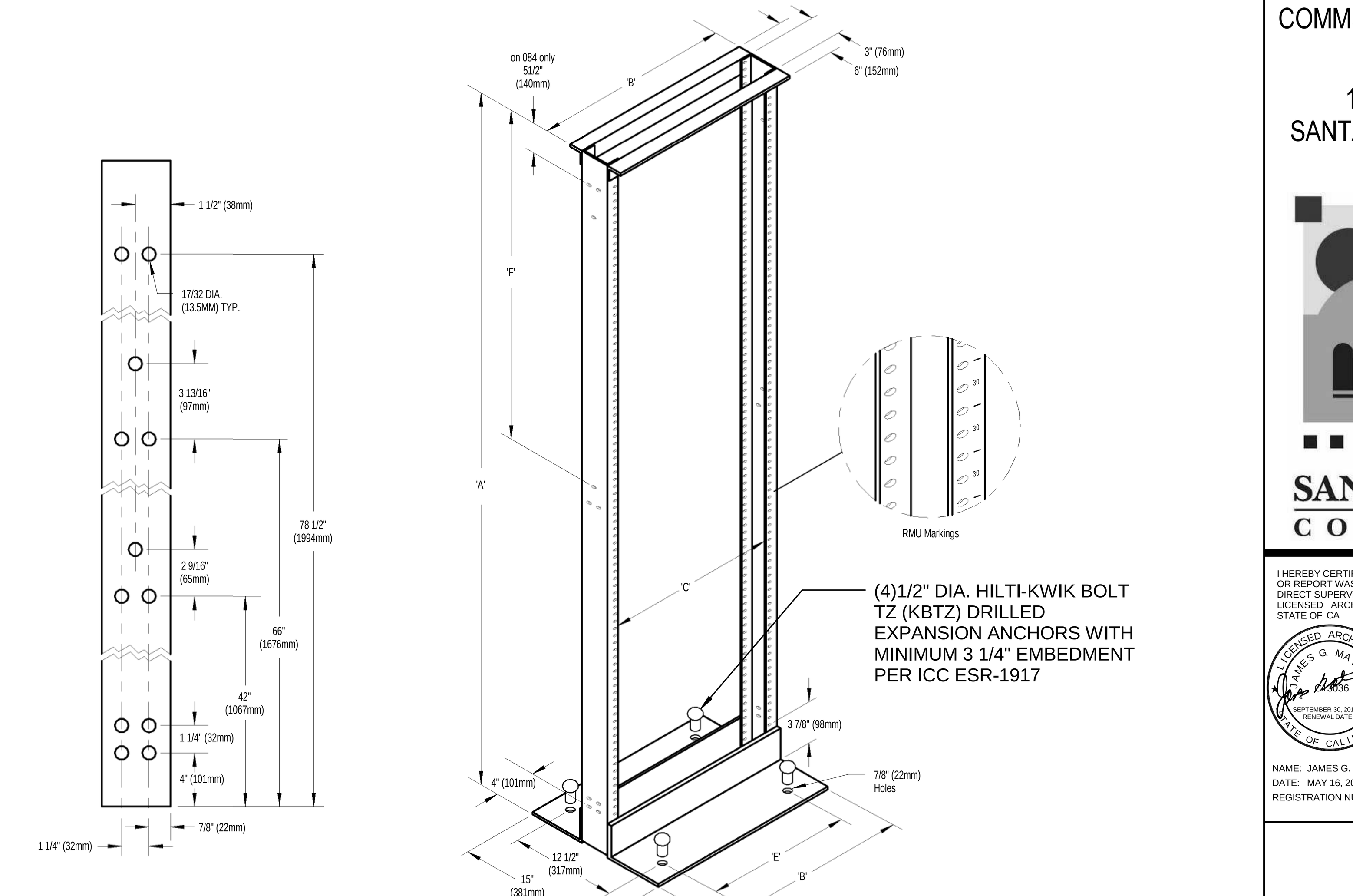


WIREMOLD/LEGRAND 10" EVOLUTION SERIES POKE-THROUGH
SCALE N.T.S. — 5

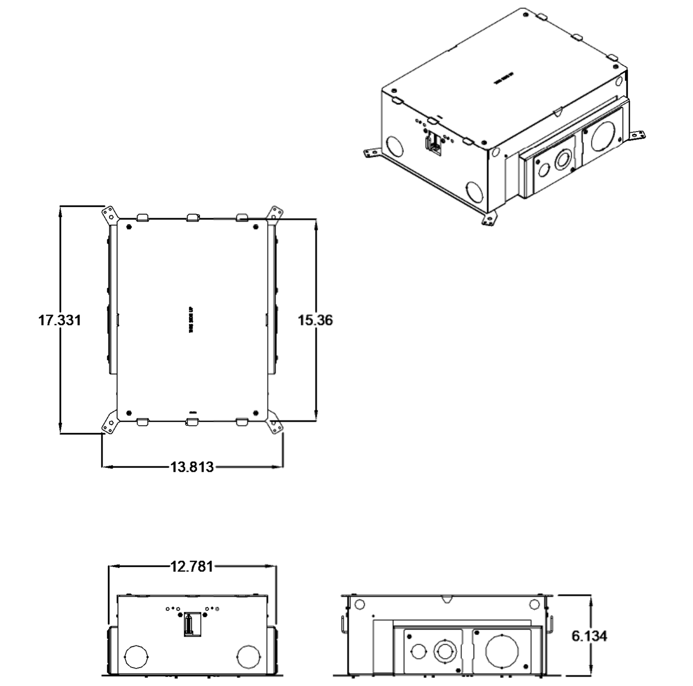


REFERENCE SPEC. SECTION 271000
FOR ADDITIONAL REQUIREMENTS

TECHNICAL GROUND BUS - ALL IDF'S
SCALE N.T.S. — 3



2 - POST RACK ANCHORAGE DETAIL
SCALE N.T.S. — 1



WIREMOLD/LEGRAND EVOLUTION SERIES 8 GANG FLOOR BOX
SCALE N.T.S. — 6

TELECOM SYMBOL LIST

Symbol	Description
TV	TELEVISION/COAX SYSTEM - 1"C. WITH COAX CABLE AS SPECIFIED.
M1	MICROPHONE SYSTEM - 3/4"C. WITH CABLING AS SPECIFIED. (3) M2 - 1"C. WITH CABLING AS SPECIFIED. M3 - 1 1/4"C. WITH CABLING AS SPECIFIED. M4 - (2) 1"C. WITH CABLING AS SPECIFIED.
ID	INTRUSION DETECTION SYSTEM-3/4"C., WITH INTRUSION DETECTION SYSTEM CABLING AS SPECIFIED.
1V	TELEPHONE/VOICE SYSTEM - 3/4"C. WITH ONE (1) TELEPHONE SYSTEM CABLE AS SPECIFIED. V2 - 1"C. WITH TWO (2) TELEPHONE SYSTEM CABLES AS SPECIFIED. V3 - 1 1/4"C. WITH THREE (3) TELEPHONE SYSTEM CABLES AS SPECIFIED. V4 - 1 1/4"C. WITH FOUR (4) TELEPHONE SYSTEM CABLES AS SPECIFIED.
P	PUBLIC ADDRESS SYSTEM - 3/4"C., WITH PA SYSTEM CABLING AS SPECIFIED.
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.
2D AP	COMPUTER/DATA OUTLET, WITH TWO (2) OUTLET CONNECTORS, ON FLUSH CEILING MOUNTED OUTLET BOX FOR WIRELESS ACCESS POINT. PROVIDE OUTLET BOX, DATA JACKS AND TWO (2) CAT6 DATA NETWORK CABLES AS SPECIFIED FROM THE OUTLET TO THE RESPECTIVE IDF/MDF. PROVIDE 15'-0" ADDITIONAL SLACK IN CABLE COILED ABOVE CEILING FOR POTENTIAL ADJUSTMENT OF WIRELESS ACCESS POINT. (3)
2D	COMPUTER/DATA OUTLET, WITH TWO (2) OUTLET CONNECTORS, ON FLUSH WALL MOUNTED OUTLET BOX +18". PROVIDE OUTLET BOX, DATA JACKS AND 1" CONDUIT TO ACCESSIBLE CEILING SPACE UNLESS NOTED OTHERWISE. PROVIDE TWO (2) CAT6 DATA NETWORK CABLES AS SPECIFIED FROM THE OUTLET TO THE RESPECTIVE IDF/MDF. "C" DESIGNATION INDICATES MOUNT OUTLET +6" ABOVE THE COUNTER SPLASH.
1D	COMPUTER/DATA OUTLET, WITH A SINGLE OUTLET CONNECTOR, ON FLUSH WALL MOUNTED OUTLET BOX +18". PROVIDE OUTLET BOX, DATA JACKS AND 1" CONDUIT TO ACCESSIBLE CEILING SPACE UNLESS NOTED OTHERWISE. PROVIDE ONE(1) CAT6 DATA NETWORK CABLES AS SPECIFIED FROM THE OUTLET TO THE RESPECTIVE IDF/BDF. "W" INDICATES WALL MOUNT AT +45" FOR VOICE. "C" DESIGNATION INDICATES MOUNT OUTLET +6" ABOVE THE COUNTER SPLASH. "P" DESIGNATION INDICATES AT PROJECTOR. "S" DESIGNATION INDICATES FOR SECURITY.
1V	VOICE OUTLET, WITH A TWO (2) OUTLET CONNECTORS, ON FLUSH WALL MOUNTED OUTLET BOX +18". PROVIDE OUTLET BOX, VOICE JACKS AND 1" CONDUIT TO ACCESSIBLE CEILING SPACE UNLESS NOTED OTHERWISE. PROVIDE TWO(2) CAT6 DATA NETWORK CABLES AS SPECIFIED FROM THE OUTLET TO THE RESPECTIVE IDF/BDF. "W" INDICATES WALL MOUNT AT +45" FOR VOICE, PROVIDE STAINLESS STEEL WALL PLATE WITH HANGER. "C" DESIGNATION INDICATES MOUNT OUTLET +6" ABOVE THE COUNTER SPLASH. "P" DESIGNATION INDICATES AT PROJECTOR. "S" DESIGNATION INDICATES FOR SECURITY.
"E"	DESIGNATION INDICATES DEDICATED TELEPHONE LINES FOR ELEVATOR.
M	INTERCOM MICROPHONE ON FLUSH CEILING MOUNTED OUTLET BOX.
S	AUDIO ENHANCEMENT SPEAKER IN FLUSH CEILING MOUNTED BACKBOX.
(clock)	12.5" DIA. ANALOG SELF CORRECTING 120V. OPERATED CLOCK, +90" A.F.F. REFER TO ARCHITECTURAL INTERIOR ELEVATIONS FOR EXACT LOCATIONS AND MOUNTING HEIGHTS. (3)
+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	WEATHERPROOF EXTERIOR LONG THROW PUBLIC ADDRESS HORN SPEAKER, WALL MOUNTED.
AV	AUDIO/VIDEO OUTLET, ON FLUSH WALL MOUNTED OUTLET BOX WITH COVERPLATE AND GROMETTED OPENING. PROVIDE OUTLET BOX, COVERPLATE AND 2" CONDUIT CONCEALED IN WALL TO THE ACCESSIBLE CEILING SPACE UNLESS NOTED OTHERWISE. PROVIDE VGA AND USB CABLE FROM THE TEACHER'S DESK TO THE INTERACTIVE WHITEBOARD AND SHORT THROW PROJECTOR OUTLET LOCATED AT THE TEACHING WALL. MOUNT AV OUTLET AT TEACHER'S DESK AT +18". MOUNT AV OUTLET AT INTERACTIVE WHITEBOARD AT +70". (3)
TC	AUDIO/VIDEO CONTROL PANEL, ON FLUSH IN WALL MOUNTED OUTLET BOX, +45" A.F.F. LOCATED AT TEACHER'S DESK. PROVIDE CONTROL PANEL, OUTLET BOX AND 1" CONDUIT CONCEALED IN WALL DOWN TO AV CONNECTOR PLATE AT +18" A.F.F. PROVIDE AV CABLING BETWEEN AV CONTROL PANEL AND AV CONNECTOR PLATE IN ACCORDANCE WITH THE AV SYSTEM REQUIREMENTS. (3)
K	INTRUSION DETECTION KEY PAD, ON FLUSH WALL MOUNTED OUTLET BOX, +45".
C	INTRUSION DETECTION SYSTEM DOOR CONTACT SWITCH. INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS.
ID	INTRUSION DETECTION OCCUPANCY MOTION SENSOR, ON FLUSH CEILING MOUNTED OUTLET BOX.
M	MICROPHONE OUTLET, ON FLUSH WALL MOUNTED OUTLET BOX, +18".
E	ASSISTIVE LISTENING SYSTEM EMITTER, +90".
VP	HANDS-FREE IP CALL BOX, FLUSH WALL MOUNT, +45".
AV	A/V SYSTEM - PROVIDE 2"C. FROM MEDIA LINK CONTROLLER TO SWITCHER AT PROJECTOR.
TV	TELEVISION/COAX OUTLET ON FLUSH IN WALL OUTLET, +60" U.N.O. (3)
1V 2D	COMBINATION VOICE/DATA NETWORK OUTLET ON FLUSH IN WALL OUTLET BOX, +18", U.N.O. PROVIDE ONE(1) VOICE AND TWO(2) COMPUTER NETWORK CONNECTORS AND COVERPLAATES AS SPECIFIED. PROVIDE ONE(1) VOICE AND TWO(2) DATA NETWORK CABLES AS SPECIFIED FROM OUTLET TO ABOVE CEILING AND ON TO CABLE TRAY. TERMINATE CABLING AT THE RESPECTIVE BDF/MDF/IDF. (3)
AV	COMBINATION DATA/POWER/AUDIO VIDEO FLOOR BOX FLUSH WITH GRADE WITH TWO (2) DATA OUTLET, TWO (2) POWER OUTLET AND AUDO VISUAL JACKS, FLOOR BOX AS MANUFACTURED BY FSR.
(4)	DATA/POWER FLOOR BOX WITH FOUR (4) DATA OUTLETS AND TWO (2) DUPLEX RECEPTACLES, WIREMOLD RFB SERIES OR EQUAL.
(6) R	DATA/POWER FLOOR BOX WITH SIX (6) DATA OUTLETS AND THREE (3) DUPLEX RECEPTACLES, EQUAL TO WIREMOLD EVOLUTION SERIES OR EQUAL. (3)
(4) PT	WIREMOLD 10" EVOLUTION POKE-THRU, WITH TWO (2) PRE-WIRED DUPLEX RECEPTACLES, ONE (1) SINGLE GANG DEVICE PLATE FOR FOUR (4) DATA JACKS.
(6) PT	WIREMOLD 10" EVOLUTION POKE-THRU, 6ATP SERIES WITH TWO (2) PRE-WIRED DUPLEX RECEPTACLES, ONE (1) SINGLE GANG DEVICE PLATE FOR SIX (6) DATA JACKS.

TELECOM DRAWING INDEX

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T1.3	IDF ELEVATIONS
T1.4	OVERALL SITE TELECOM PLAN
T1.5	LEVEL 01 TELECOM PLAN
T1.5A	LEVEL 01 ENLARGED TELECOM PLANS
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T1.7C	LEVEL 03 ENLARGED TELECOM PLANS

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: FBA — REVIEW BY: R. Rogers

HGA NO: 3584-001-00

TELECOM SYMBOL LIST, NOTES AND DETAILS

DATE: JULY 06, 2017

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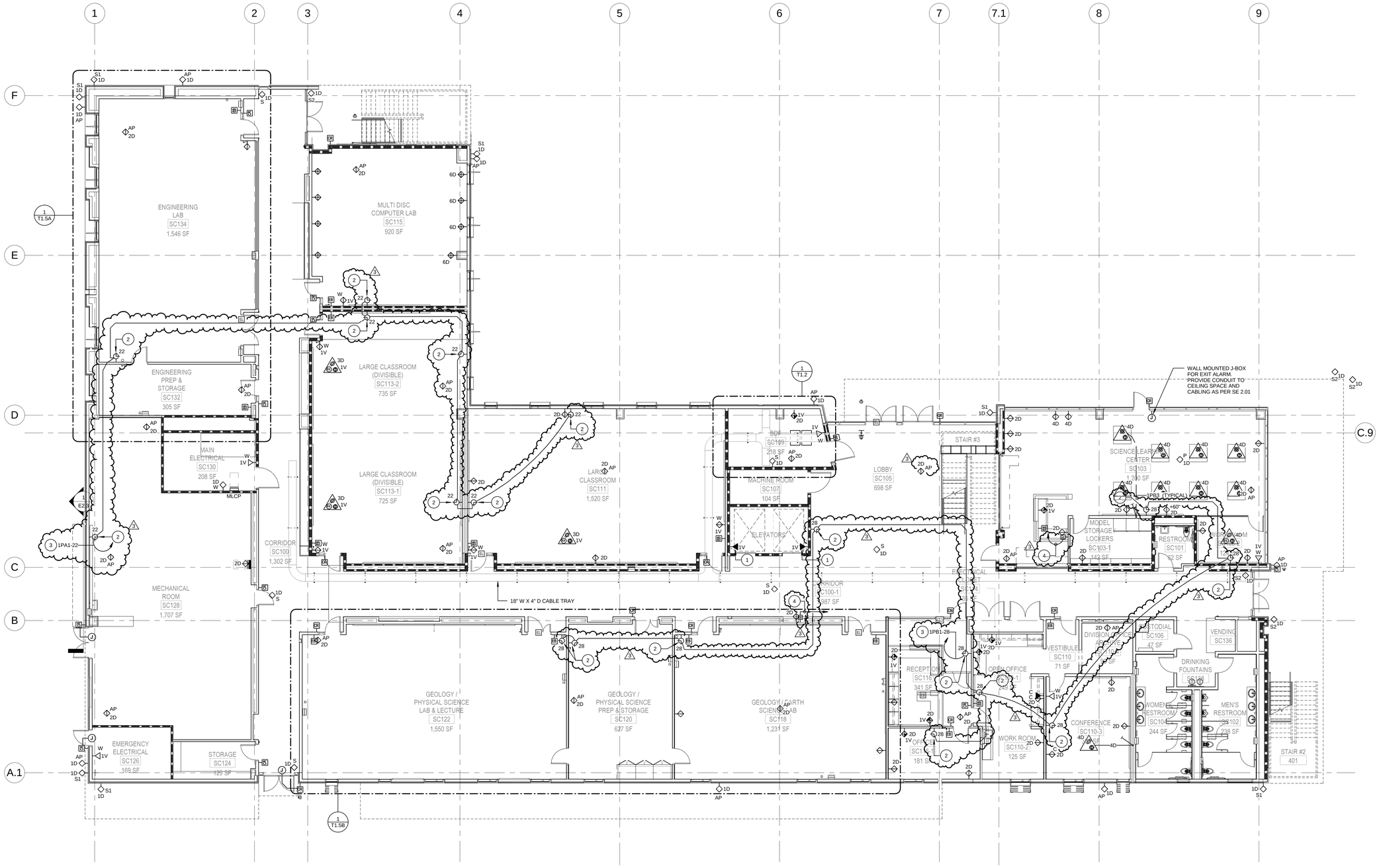

1 LEVEL 01 TELECOM PLAN
1/8" = 1'-0"

PLAN NOTES:

1. CONNECT TO ELEVATOR CAB TELEPHONE(S) IN ACCORDANCE WITH THE ELEVATOR EQUIPMENT MANUFACTURER'S REQUIREMENTS.
2. CONNECT TO 120V. CLOCK. VERIFY LOCATION WITH ARCHITECT.
3. PROVIDE 2#12, 1#12 GRD. - 1/2"C. TO PANEL INDICATED.
4. PROVIDE 1"C. WITH COAX CABLE TO BDF ROOM SC109. VERIFY LOCATION AND PROVIDE CABLE AS SPECIFIED.

1918 Main Street, Third Floor
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Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
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626-304-2616

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SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
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213-418-0201

LANDSCAPE ARCHITECT
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IRVINE, CA 92614
949-756-0150

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619-297-0159

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RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 01 TELECOM PLAN

DATE: JULY 06, 2017

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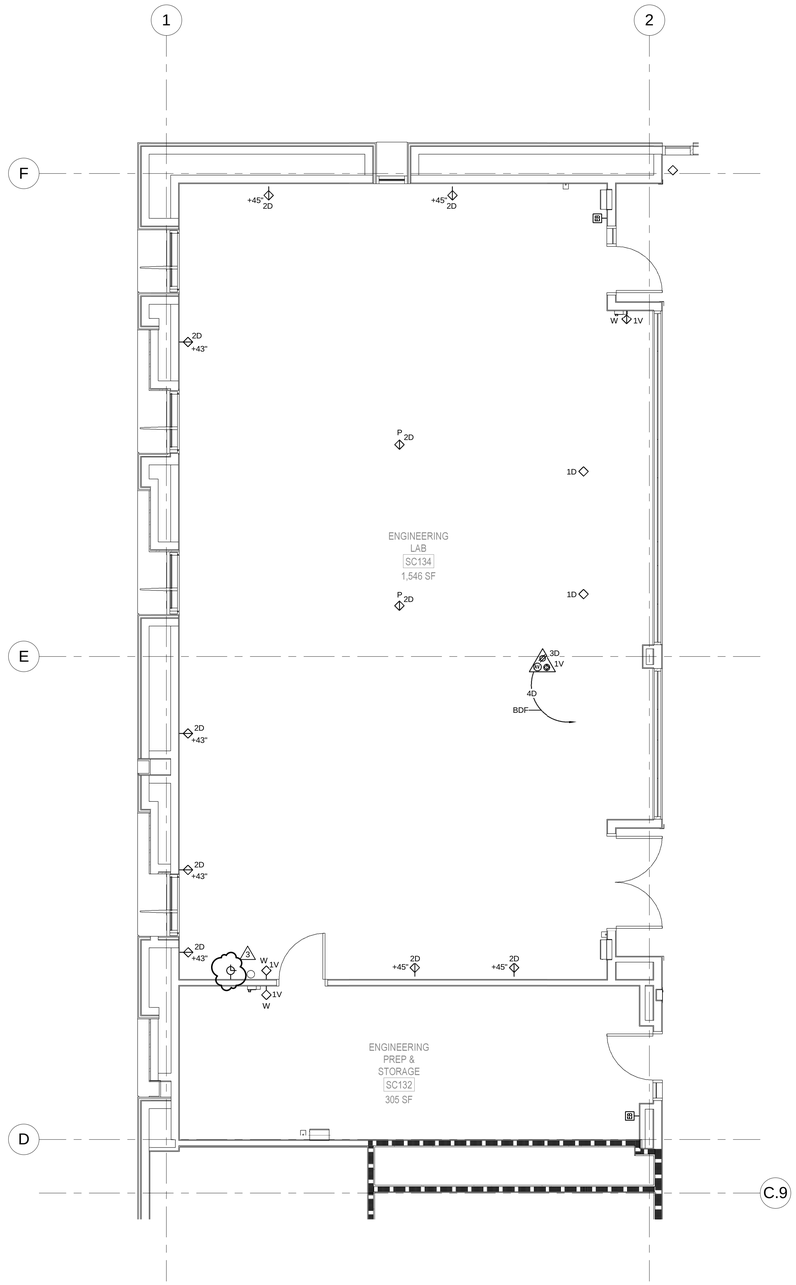

1 LEVEL 01 ENLARGED ENGINEERING SUPPORT SC130 AND ENGINEERING LAB SC132 TELECOM PLAN
1/4" = 1'-0"

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LICENSED ARCHITECT JAMES G. MATSON No. 13036 SEPTEMBER 30, 2017 REGISTRATION DATE STATE OF CALIFORNIA

LICENSED ARCHITECT JAMES G. MATSON No. 13036 SEPTEMBER 30, 2017 REGISTRATION DATE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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LEVEL 01 ENLARGED TELECOM PLANS

DATE: JULY 06, 2017

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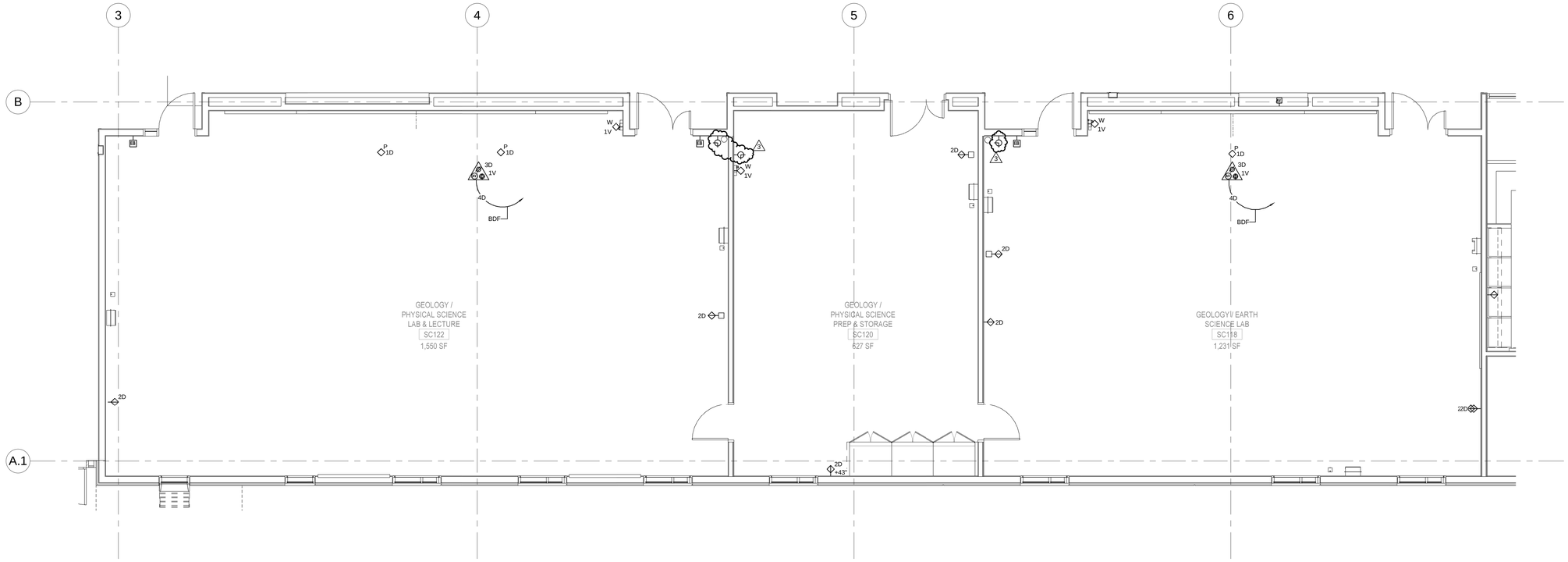

1 LEVEL 01 ENLARGED SC116, SC118 AND SC120 TELECOM PLAN
1/4" = 1'-0"

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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LEVEL 01 ENLARGED TELECOM PLANS

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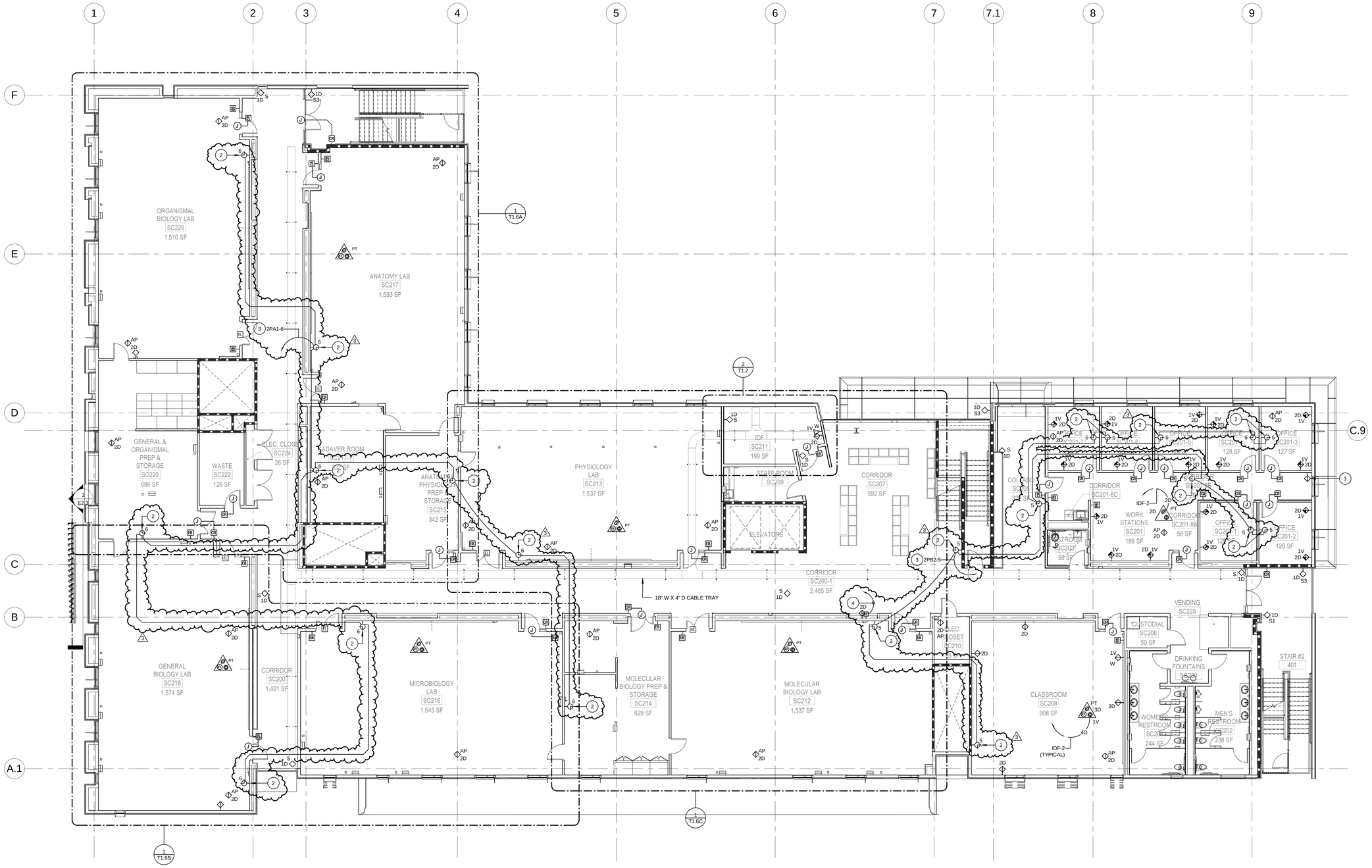

1 LEVEL 02 TELECOM PLAN
1/8" = 1'-0"

PLAN NOTES:

1. FOR CONNECTION TO PRINTER.
2. CONNECT TO 120V. CLOCK. VERIFY LOCATION WITH ARCHITECT.
3. PROVIDE 2#12, 1#12 GRD. - 1/2"C. TO PANEL INDICATED.
4. PROVIDE 1"C. WITH COAX CABLE TO IDF ROOM SC211. VERI LOCATION AND PROVIDE CABLE AS SPECIFIED.

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KPFF CONSULTING ENGINEERS
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LICENSED ARCHITECT JAMES G. MATSON 12-18-2017 REGISTERED ENGINEER 12-18-2017 ELECTRICAL STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

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LEVEL 02 TELECOM PLAN

DATE: JULY 06, 2017

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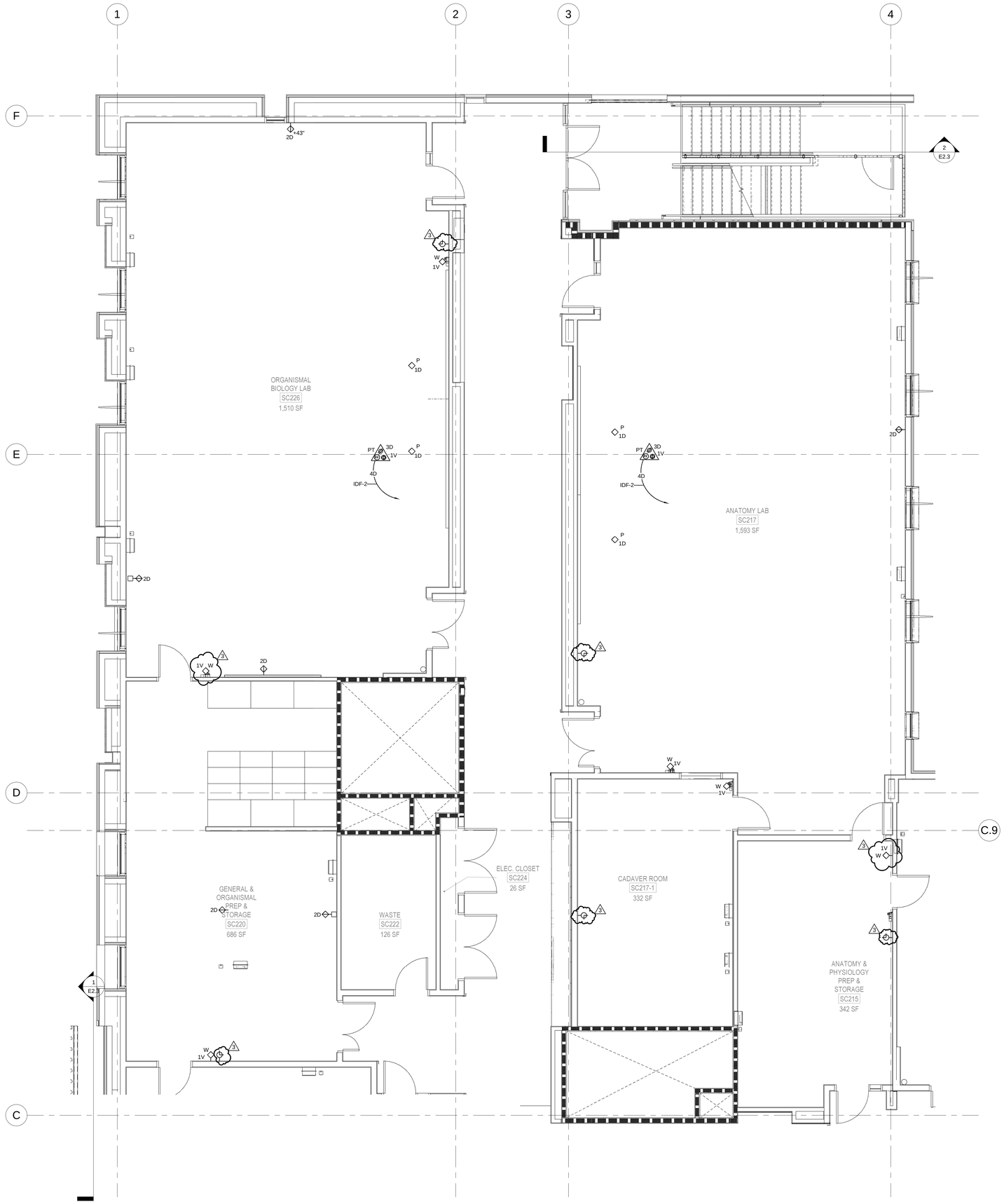

1 LEVEL 02 ENLARGED SC213, SC215, SC215-1, SC220, SC222, SC224 AND SC226 TELECOM PLAN
1/4" = 1'-0"

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FBA ENGINEERING
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NAME: JAMES G. MATSON
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DRAWN BY: FBA | REVIEW BY: R. Rogers

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LEVEL 02 ENLARGED TELECOM PLANS

DATE: JULY 06, 2017

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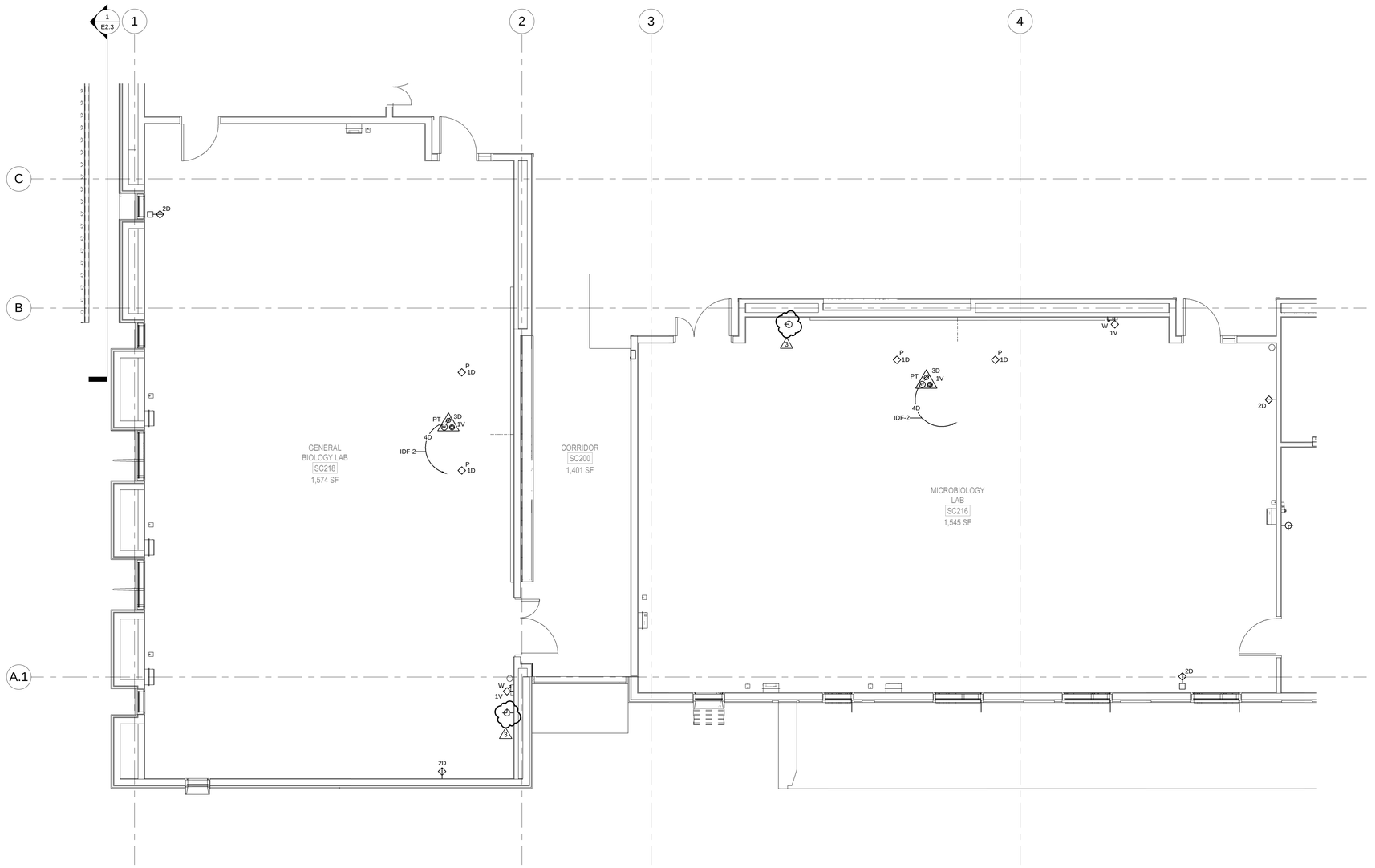

1 LEVEL 02 ENLARGED SC216 AND SC218 TELECOM PLAN
1/4" = 1'-0"

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KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
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LICENSED ARCHITECT JAMES G. MATSON 13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

LICENSED STRUCTURAL ENGINEER JAMES G. MATSON 13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

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LEVEL 02 ENLARGED TELECOM PLANS

DATE: JULY 06, 2017

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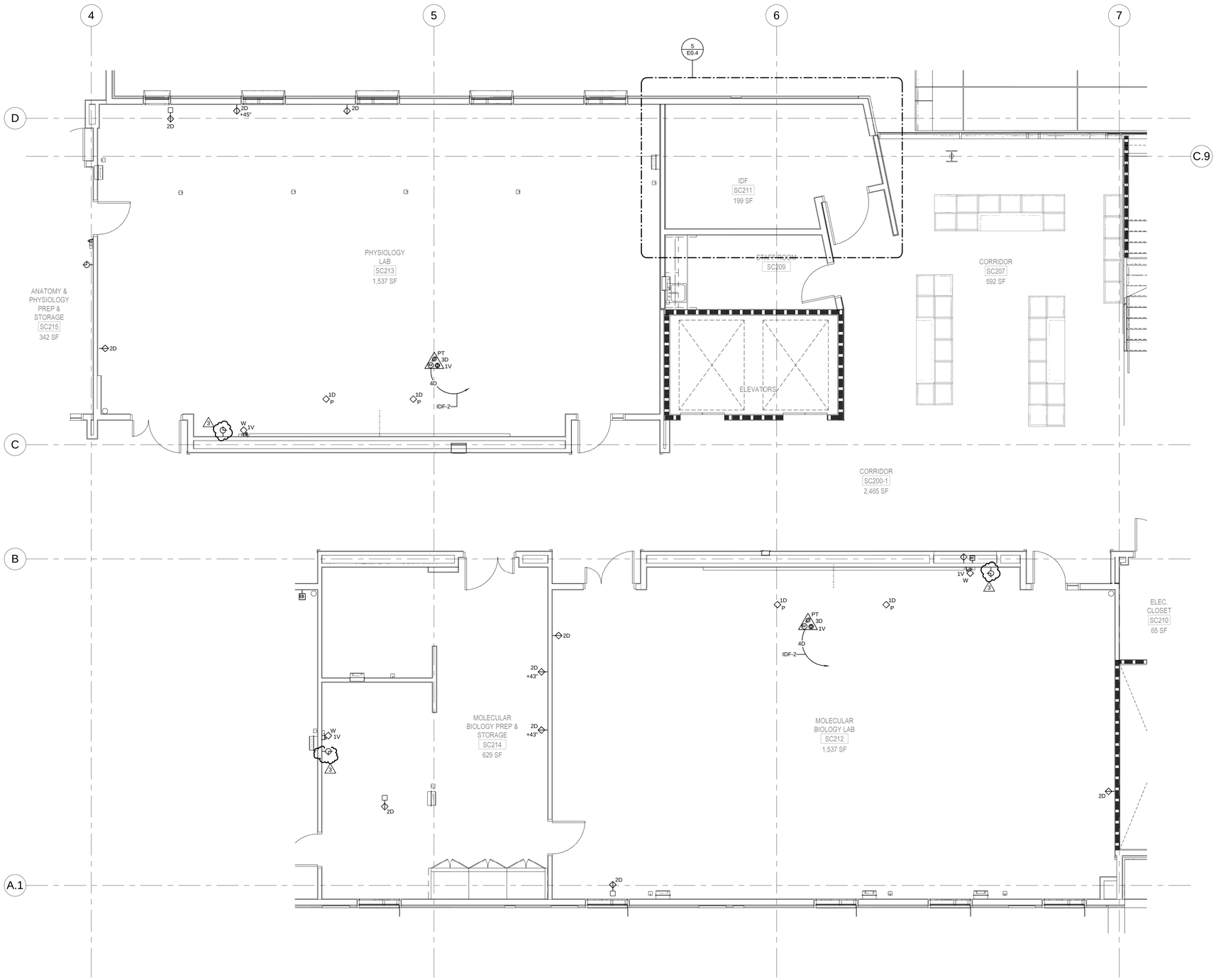

1 LEVEL 02 ENLARGED SC211, SC212 AND SC214 TELECOM PLAN
1/4" = 1'-0"

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LEVEL 02 ENLARGED TELECOM PLANS

DATE: JULY 06, 2017

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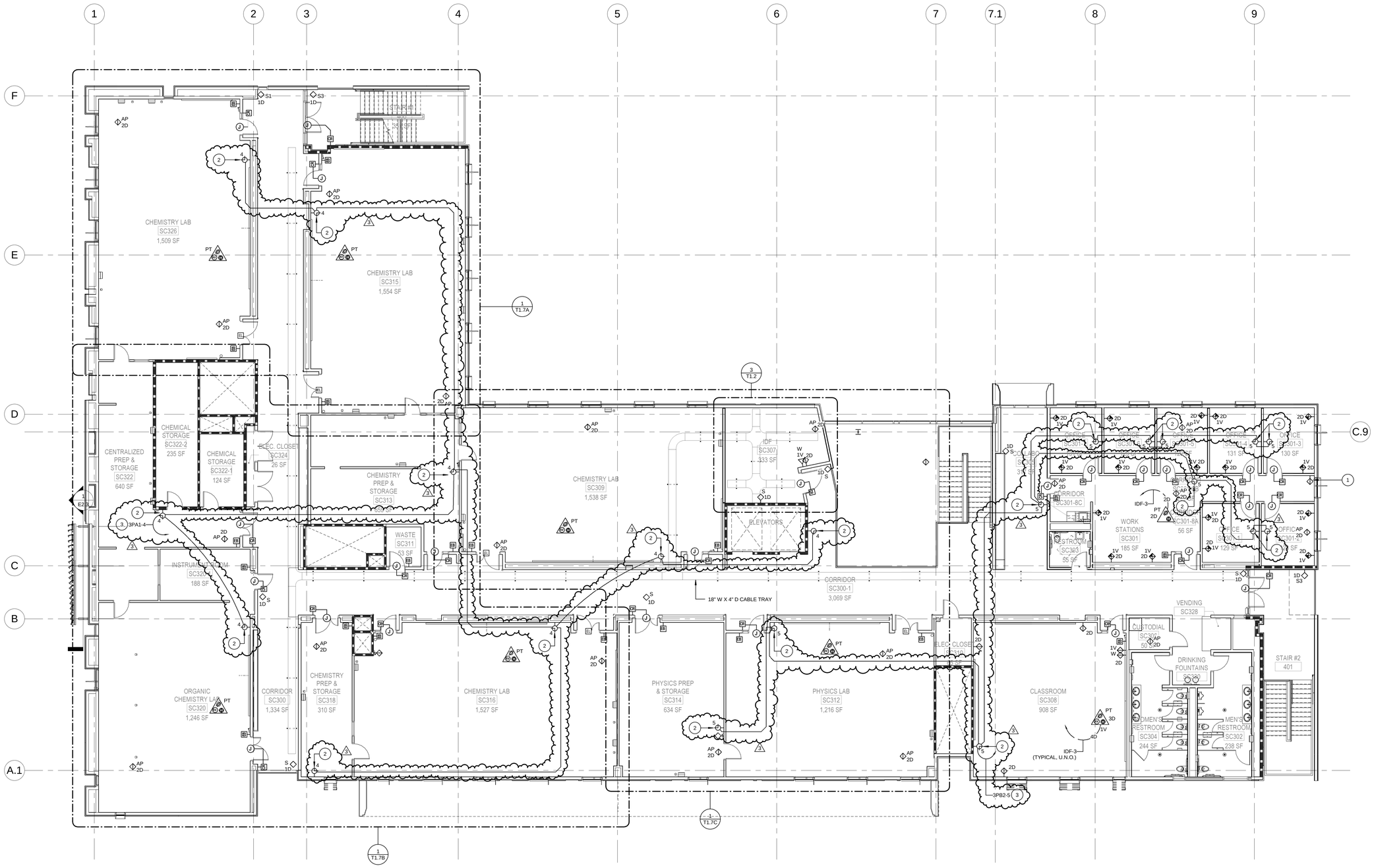

1 LEVEL 03 TELECOM PLAN
1/8" = 1'-0"

PLAN NOTES:

1. FOR CONNECTION TO PRINTER.
2. CONNECT TO 120V. CLOCK. VERIFY LOCATION WITH ARCHITECT.
3. PROVIDE 2#12, 1#12 GRD. TO PANEL INDICATED.

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LEVEL 03 TELECOM PLAN

DATE: JULY 06, 2017

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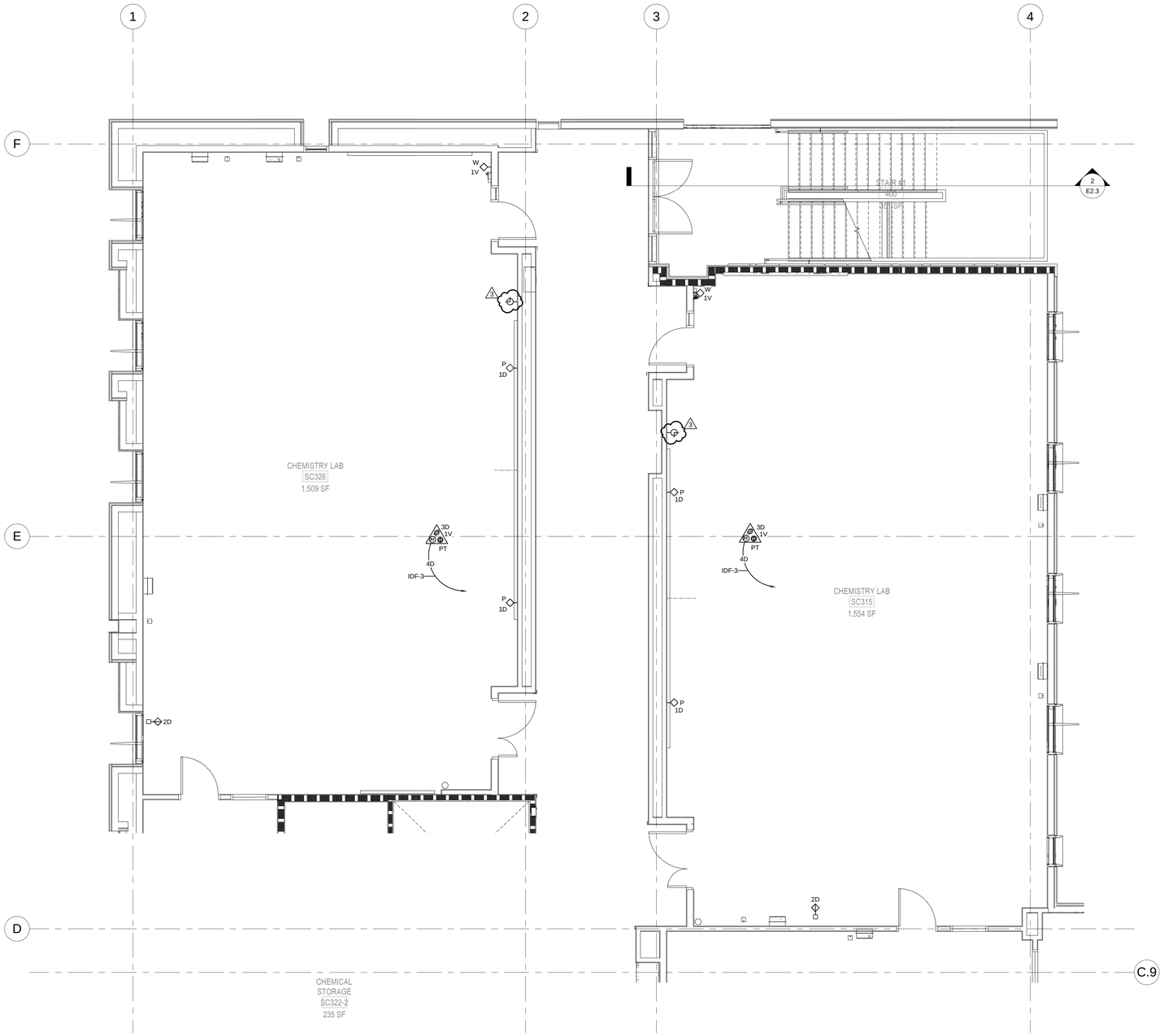

1 LEVEL 03 ENLARGED SC315 AND SC328 TELECOM PLAN
1/4" = 1'-0"

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DISTRICT

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SANTA ANA, CA 92706

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COLLEGE

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REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 03 ENLARGED TELECOM PLANS

DATE: JULY 06, 2017

T1.7A

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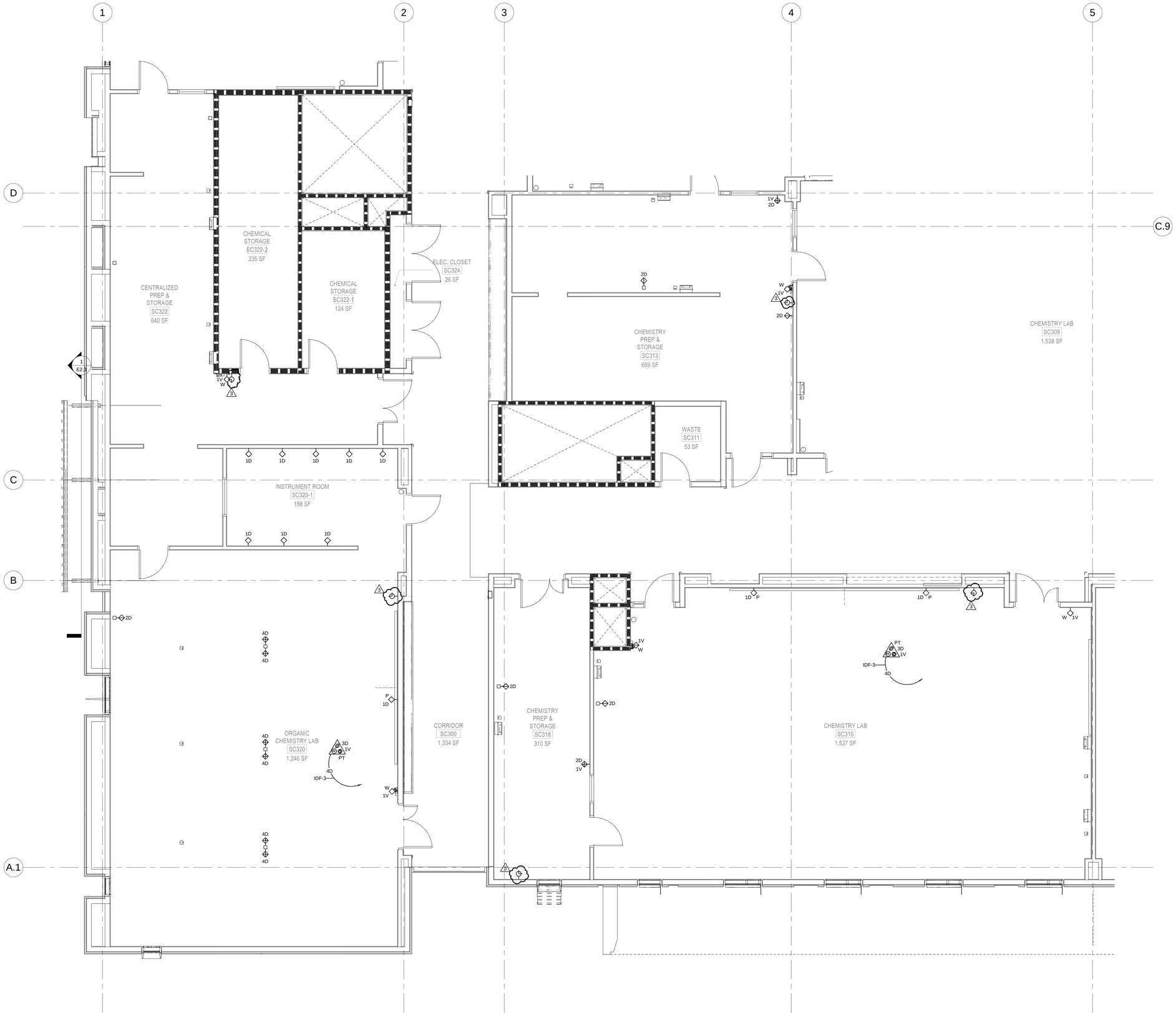

1 LEVEL 03 ENLARGED SC311, SC313, SC316, SC318, SC320, SC320-1, SC322, SC322-1, SC322-2 AND SC326 TELECOM PLAN
1/4" = 1'-0"

1918 Main Street,Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
SAN DIEGO, CA 92103
619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE

RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF

NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 03 ENLARGED TELECOM PLANS

DATE: JULY 06, 2017

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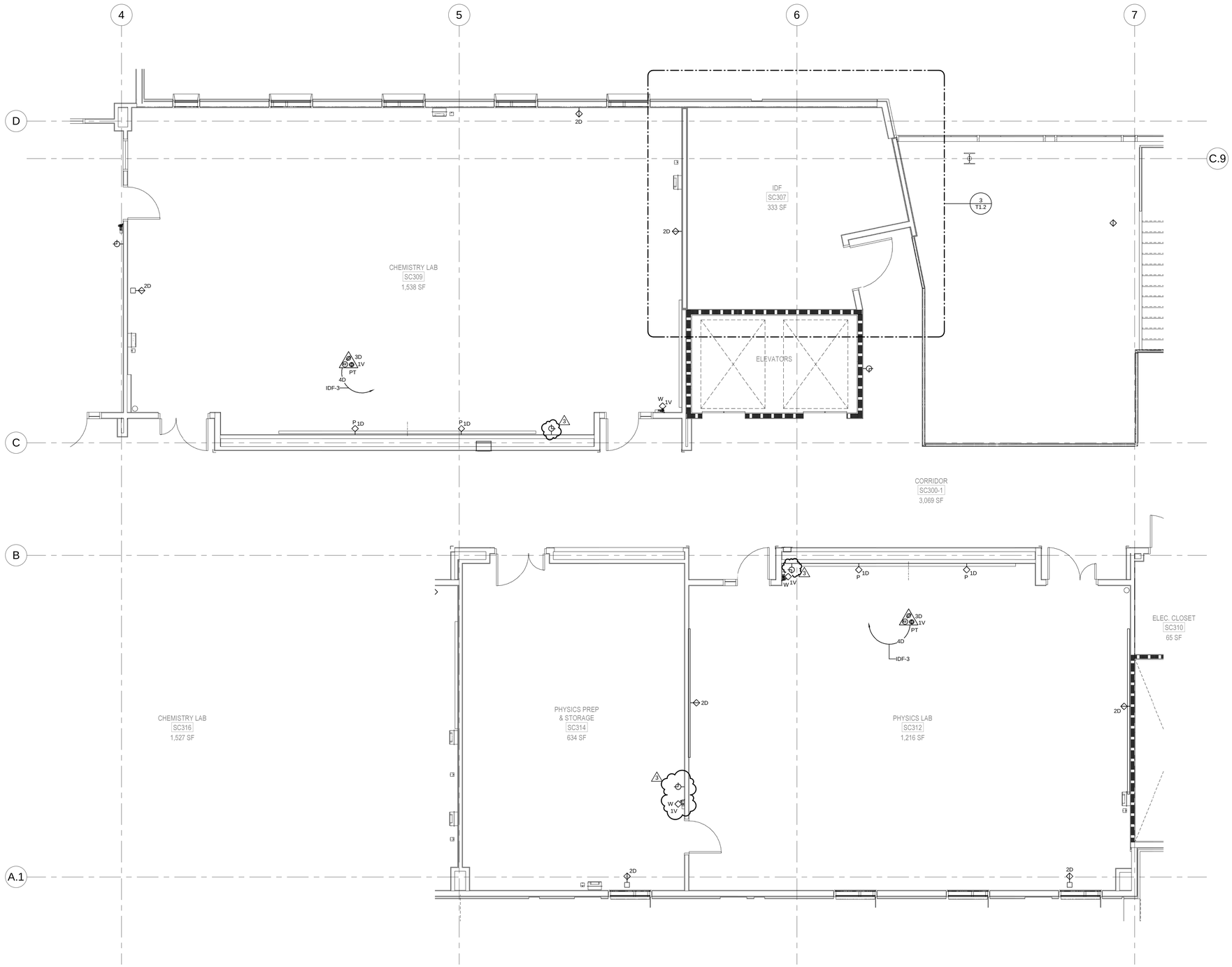

1 LEVEL 03 ENLARGED SC309, SC312 AND SC314 TELECOM PLAN
1/4" = 1'-0"

HGA
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
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626-304-2616

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818-377-8220

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FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

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KPFF CONSULTING ENGINEERS
700 SOUTH FLOWER ST. #2100
LOS ANGELES, CA 90017
213-418-0201

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SANTA ANA, CA 92706

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NAME: JAMES G. MATSON
DATE: MAY 16, 2017
REGISTRATION NUMBER: C13036

NO	DESCRIPTION	DATE
3	ADDENDUM 3	9/22/17

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: FBA | REVIEW BY: R. Rogers

HGA NO: 3584-001-00

LEVEL 03 ENLARGED TELECOM PLANS

DATE: JULY 06, 2017

T1.7C

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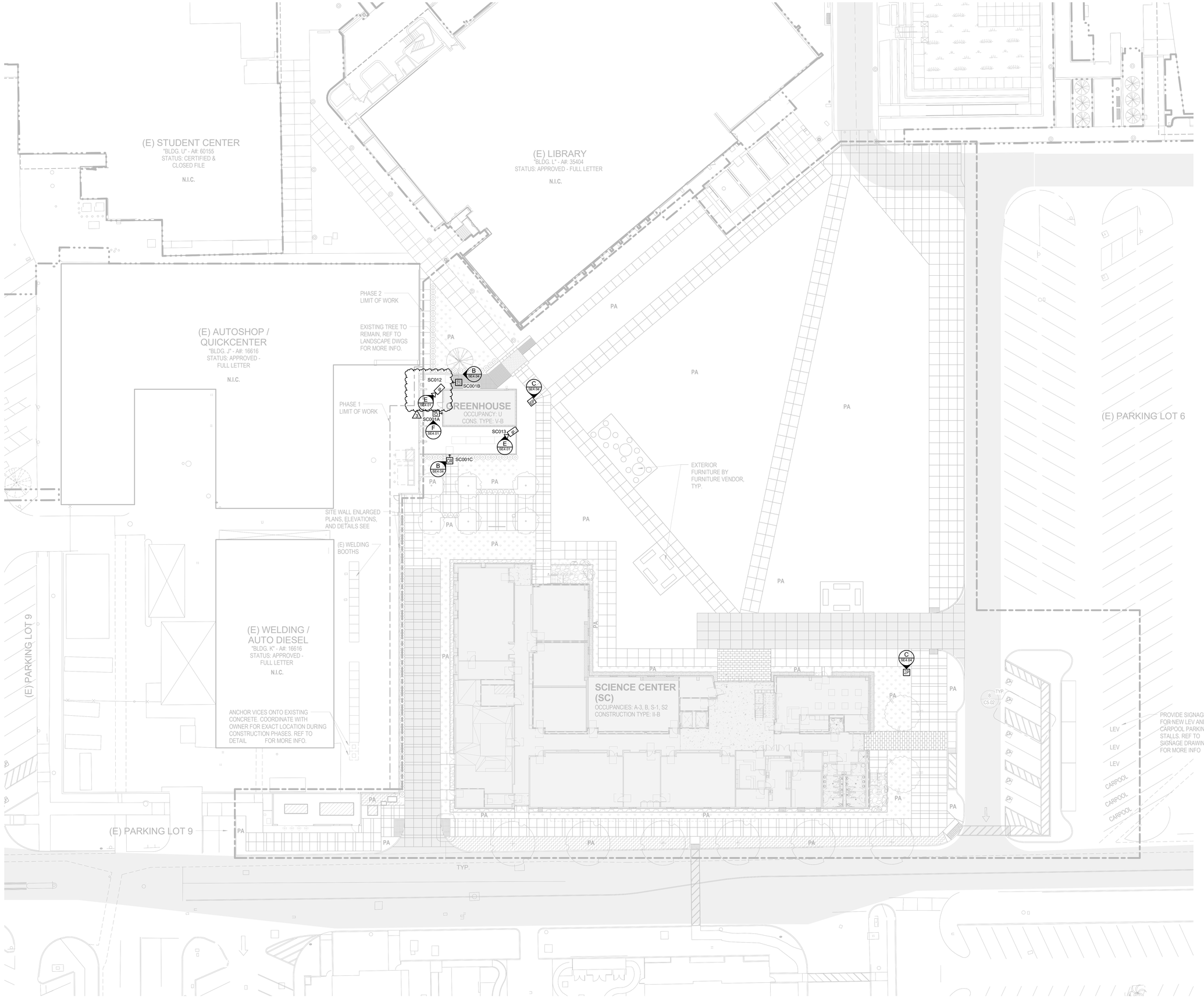

1 SECURITY ELECTRONICS SITE PLAN
1" = 20'-0"

1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

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FBA ENGINEERING
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COSTA MESA, CA 92626
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949-756-0150

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1530 W. 17TH ST.
SANTA ANA, CA 92706

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA

JAMES G. MATHIESON
LICENSED ARCHITECT
No. C-10878
SEPTEMBER 30, 2017
RENEWAL DATE
STATE OF CALIFORNIA

NAME:
DATE:
REGISTRATION NUMBER:

NO	DESCRIPTION	DATE
2	ADDENDUM 2	09/01/2017
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

SECURITY ELECTRONICS SITE PLAN

DATE: JULY 06, 2017

SE1.11

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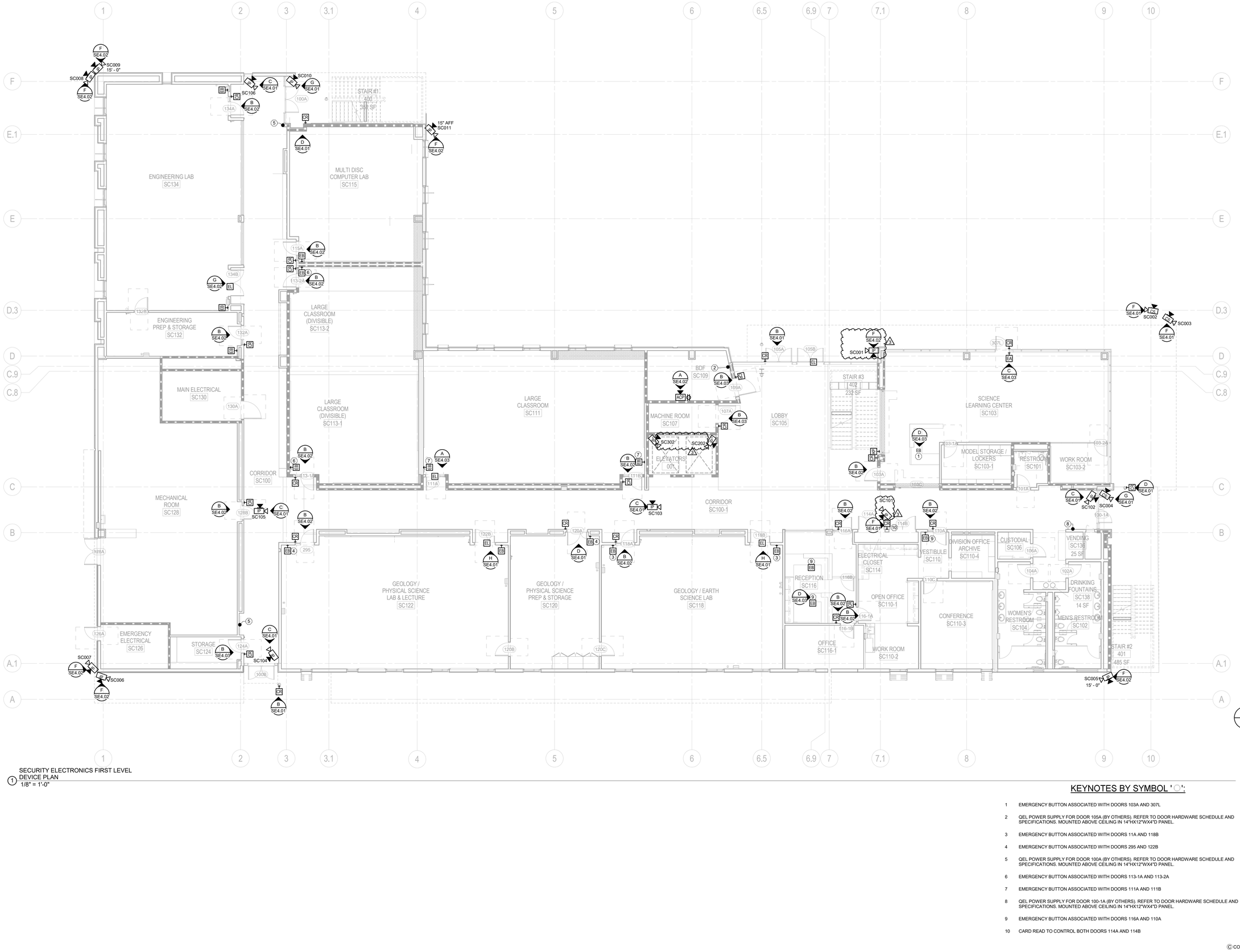

SECURITY ELECTRONICS FIRST LEVEL DEVICE PLAN
1/8" = 1'-0"

KEYNOTES BY SYMBOL '○':

1 EMERGENCY BUTTON ASSOCIATED WITH DOORS 103A AND 307L

2 QEL POWER SUPPLY FOR DOOR 105A (BY OTHERS). REFER TO DOOR HARDWARE SCHEDULE AND SPECIFICATIONS. MOUNTED ABOVE CEILING IN 14"HX12"WX4"D PANEL.

3 EMERGENCY BUTTON ASSOCIATED WITH DOORS 11A AND 118B

4 EMERGENCY BUTTON ASSOCIATED WITH DOORS 295 AND 122B

5 QEL POWER SUPPLY FOR DOOR 100A (BY OTHERS). REFER TO DOOR HARDWARE SCHEDULE AND SPECIFICATIONS. MOUNTED ABOVE CEILING IN 14"HX12"WX4"D PANEL.

6 EMERGENCY BUTTON ASSOCIATED WITH DOORS 113-1A AND 113-2A

7 EMERGENCY BUTTON ASSOCIATED WITH DOORS 111A AND 111B

8 QEL POWER SUPPLY FOR DOOR 100-1A (BY OTHERS). REFER TO DOOR HARDWARE SCHEDULE AND SPECIFICATIONS. MOUNTED ABOVE CEILING IN 14"HX12"WX4"D PANEL.

9 EMERGENCY BUTTON ASSOCIATED WITH DOORS 116A AND 110A

10 CARD READ TO CONTROL BOTH DOORS 114A AND 114B

hga.
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
14130 RIVERSIDE DR. # 201
SHERMAN OAKS, CA 91423
818-377-8220

ELECTRICAL ENGINEER
FBA ENGINEERING
150 PAULARINO AVE. #A120
COSTA MESA, CA 92626
949-852-9995

CIVIL ENGINEER
KPFF CONSULTING ENGINEERS
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213-418-0201

LANDSCAPE ARCHITECT
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949-756-0150

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RESEARCH FACILITIES DESIGN
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619-297-0159

SCIENCE CENTER
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RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

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LICENSED ARCHITECT JAMES G. MATTHIESEN No. C-26000 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

NAME:
DATE:
REGISTRATION NUMBER:

NO	DESCRIPTION	DATE
2	ADDENDUM 2	09/01/2017
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

SECURITY ELECTRONICS FIRST LEVEL DEVICE PLAN

DATE: JULY 06, 2017

SE2.01

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1 SECURITY ELECTRONICS SECOND LEVEL DEVICE PLAN
1/8" = 1'-0"

KEYNOTES BY SYMBOL '○':

HGA
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
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SHERMAN OAKS, CA 91423
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213-418-0201

LANDSCAPE ARCHITECT
LYNN CAPOUYA, INC.
17992 MITCHELL SOUTH, #110
IRVINE, CA 92614
949-756-0150

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RESEARCH FACILITIES DESIGN
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SAN DIEGO, CA 92103
619-297-0159

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1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

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NAME:
DATE:
REGISTRATION NUMBER:

NO	DESCRIPTION	DATE
2	ADDENDUM 2	09/01/2017
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

SECURITY ELECTRONICS SECOND LEVEL DEVICE PLAN

DATE: JULY 06, 2017

SE2.02

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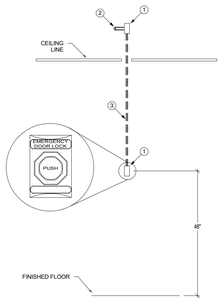
Item	Description	Qty.
1	SINGLE GANG JUNCTION BOX	1
2	EMT CONDUIT	AR
3	EMT TO NEAREST EXITING NEMA 12 ENCLOSURE	AR
4	NOT USED	-

LEGEND:

AR = AS REQUIRED
(REF SPEC) = REFERENCE SPECIFICATIONS
ITEM NUMBER = NUMBER SYMBOLS

WIRETYPE
Belden #6200FE - Plenum Rated 4-Conductor Shielded Cable

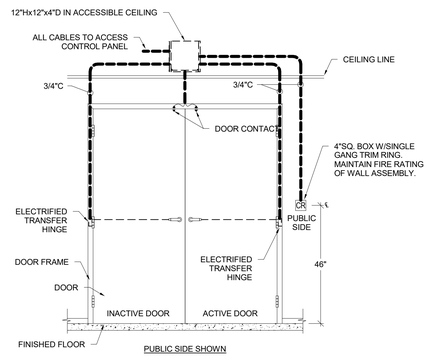


SECURE SIDE SHOWN

EMERGENCY DOOR LOCK MOUNTING DETAIL | NTS | H

NOTES:

1. COORDINATE LOCKING HARDWARE WITH HARDWARE PROVIDER UNDER OTHER SPECIFIC SECTIONS.
2. DETAILS ARE FOR REFERENCE ONLY. SEE FLOOR PLANS FOR LEFT OR RIGHT HAND PLACEMENT OF DEVICES.
3. DOOR SHALL BE PREPPED AT THE FACTORY BEFORE UL LABEL IS APPLIED.
4. IF DOOR HAS A RR (REMOTE RELEASE) ASSOCIATED TO IT THE RR WILL TRIGGER AN INPUT ON THE ACCESS CONTROL PANEL WHICH WILL ACTIVATE AN OUTPUT ON THE ACCESS CONTROL PANEL FOR THE EL (ELECTRIC LOCK).
5. REX SHALL BE INCLUDED IN DOOR HARDWARE.

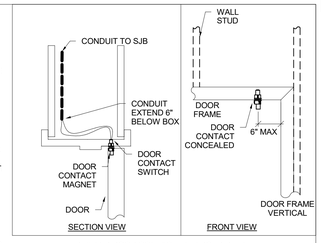


PUBLIC SIDE SHOWN

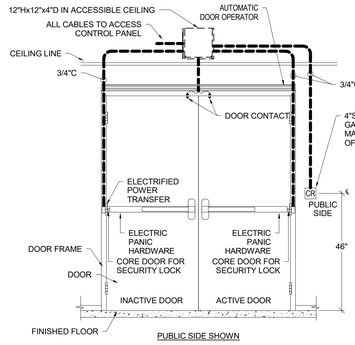
CARD READER - ELECTRIC LOCK | NTS | F

NOTES:

1. COORDINATE LOCKING HARDWARE WITH HARDWARE PROVIDER UNDER OTHER SPECIFIC SECTIONS.
2. DETAILS ARE FOR REFERENCE ONLY. SEE FLOOR PLANS FOR LEFT OR RIGHT HAND PLACEMENT OF DEVICES.
3. DOOR SHALL BE PREPPED AT THE FACTORY BEFORE UL LABEL IS APPLIED.
4. IF DOOR HAS A RR (REMOTE RELEASE) ASSOCIATED TO IT THE RR WILL TRIGGER AN INPUT ON THE ACCESS CONTROL PANEL WHICH WILL ACTIVATE AN OUTPUT ON THE ACCESS CONTROL PANEL FOR THE EL (ELECTRIC LOCK).
5. DOORS WITH AUTO OPERATORS SHALL HAVE A PUSH PLATE ON THE INTERIOR SIDE ONLY. THAT PUSH PLATE SHALL BE DOUBLE PULL DOUBLE THROW WITH ONE SIDE CONNECTED TO THE OPERATOR AND THE OTHER SIDE CONNECTED TO THE SECURITY SYSTEM ACTING AS THE REX.



REX AND DOOR CONTACT ENLARGED DETAIL

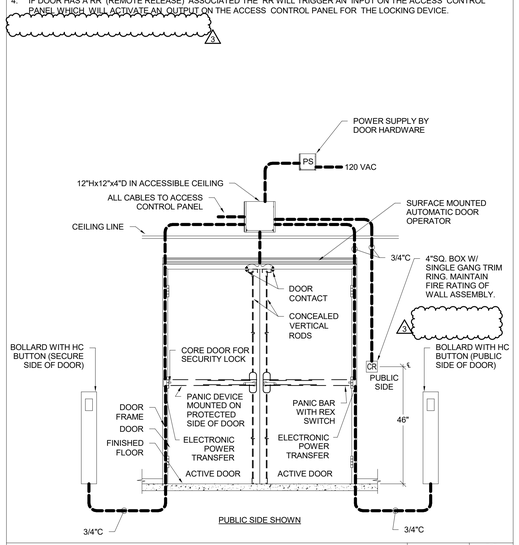


PUBLIC SIDE SHOWN

CARD READER - AUTOMATIC OPENER | NTS | D

NOTES:

1. COORDINATE LOCKING HARDWARE WITH DIVISION 08 CONTRACTOR.
2. DETAILS ARE FOR REFERENCE ONLY. SEE FLOOR PLANS FOR LEFT OR RIGHT HAND PLACEMENT OF DEVICES.
3. DOOR SHALL BE PREPPED AT THE FACTORY BEFORE UL LABEL IS APPLIED.
4. IF DOOR HAS A RR (REMOTE RELEASE) ASSOCIATED THE RR WILL TRIGGER AN INPUT ON THE ACCESS CONTROL PANEL WHICH WILL ACTIVATE AN OUTPUT ON THE ACCESS CONTROL PANEL FOR THE LOCKING DEVICE.



PUBLIC SIDE SHOWN

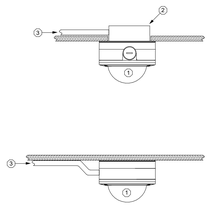
CARD READER - DOUBLE DOOR WITH MECHANICAL MULTIPOINT RIM DEVICE, CONTACTS, ELECTRIC PANIC AND AUTO OPERATORS | NTS | B

Item	Description	Qty.
1	FIXED CAMERA UNIT	1
2	DOUBLE GANG BOX	1
3	CONDUIT TO ENVS	AR
4	SAFETY WIRE/CHAIN	1
5	SUSPENSION BAR	1
6	CLEAR DOME	1
7	NOT USED	-

LEGEND:

AR = AS REQUIRED
(REF SPEC) = REFERENCE SPECIFICATIONS
ITEM NUMBER = NOTE BUBBLE

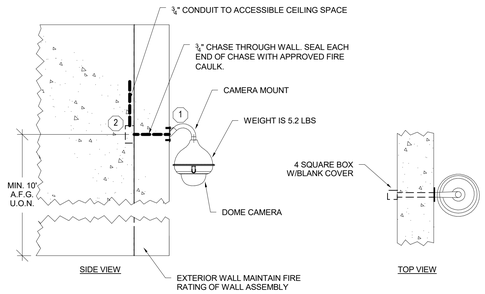
WIRETYPE
BELDEN #630948 - Plenum Rate Composite CCTV Cable



TYPICAL INTERIOR CAMERA DETAIL | NTS | G

NOTES TO DETAIL :

1. ATTACH TO WALL PER MANUFACTURERS REQUIREMENTS USING STAINLESS STEEL HARDWARE FOR MASONRY APPLICATIONS
2. PROVIDE E.O.L. RESISTOR AS REQUIRED OF SUPERVISED CIRCUIT.



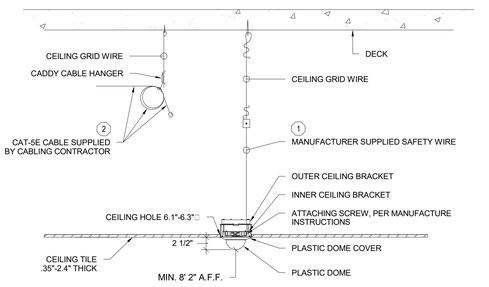
EXTERIOR WALL MOUNT CAMERA | NTS | E

GENERAL NOTES :

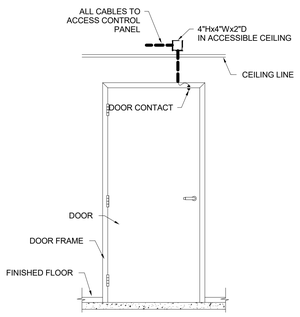
1. CAMERA WEIGHS 2.8 POUNDS.
2. NETWORK CONNECTION SHALL TERMINATE DIRECTLY TO CAMERA. DO NOT INSTALL PATCH CORD OR DMARC IN THE ACCESSIBLE CEILING.

NOTES TO DETAIL :

1. SECURE GRID WIRE TO CEILING DECK STRUCTURE AND ATTACH TO CAMERA WITH MFGR. SUPPLIED SAFETY WIRE.
2. CAT-5E CABLE, W/MIN. 6'-0" SERVICE LOOP TERMINATED TO RJ45 ATTACH SERVICE LOOP TO CEILING GRID WIRE.



SUSPENDED CEILING CAMERA MOUNTING DETAIL | NTS | C



PUBLIC SIDE SHOWN

DOOR CONTACT | NTS | A

1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
PASADENA, CA 91101
626-304-2616

MECHANICAL & PLUMBING ENGINEER
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SANTA ANA, CA 92706

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NAME:
DATE:
REGISTRATION NUMBER:

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

SECURITY ELECTRONICS DETAILS

DATE: JULY 06, 2017

SE4.01

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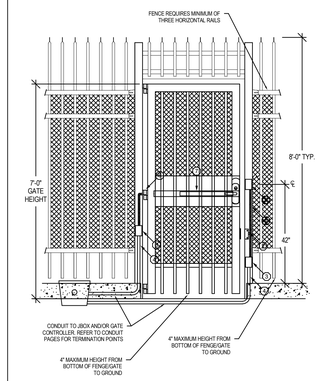
Item	Description	Qty
1	WEATHER-TIGHT FLEX CABLE	AR
2	MAGNETIC GATE CONTACT SWITCH	1
3	WEATHER PROOF BOX - SIZE ACCORDINGLY	1
4	CONDUIT - MOUNTED ON SECURED SIDE *	AR
5	CARD READER	1
6	NOT USED	-
7	ELECTRIFIED LOCK SET	1
8	ELECTRIFIED TRANSFER HINGE	

LEGEND:
AR = AS REQUIRED
(REF SPEC.) => REFERENCE SPECIFICATIONS
ITEM NUMBER = NUMBER SYMBOLS



WIRETYPE
Belden #5SRAFS - Plenum Rated Composite Security Access Control Cable

DOOR SEQUENCE OF OPERATION - CARD IN-FREE OUT

ENTRY SIDE:

THE DOOR IS EQUIPPED WITH A CARD READER ON THE PUBLIC SIDE OF THE DOOR TO CONTROL ENTRY INTO A SECURED AREA. CONTACT SWITCH MONITOR THE POSITION OF THE DOOR. USE OF THE CARD READER BYPASSES THE DOOR CONTACT SWITCH TO ALLOW ENTRY OR EGRESS. THE DOOR IS LOCKED ON THE PUBLIC SIDE.

EXIT SIDE:

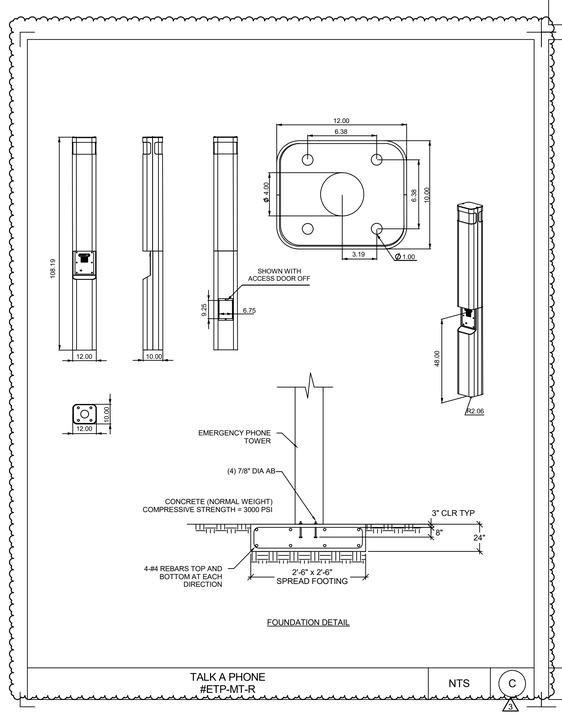
THE DOOR IS EQUIPPED ELECTRIFIED MORTISE WITH INTEGRAL REQUEST TO EXIT SWITCH TO CONTROL EXITING FROM A SECURED AREA. CONTACT SWITCH MONITOR THE POSITION OF THE DOOR. ACTIVATION OF THE REQUEST TO EXIT SWITCH BYPASSES THE DOOR CONTACT SWITCH TO ALLOW EGRESS.THE DOOR IS UNLOCKED ON THE SECURE SIDE.

DOOR STATUS :

IF THE DOOR IS HELD OPEN, A DOOR HELD OPEN ALARM WILL BE GENERATED. IF THE DOOR IS OPENED WITHOUT USE OF CARD OR ACTIVATION OF THE REQUEST TO EXIT, A DOOR FORCED ALARM WILL BE GENERATED.

NOTE: NO DOOR PROPS ARE TO BE USED ON SECURITY DOORS.

MAN GATE - CONTACT, INTERCOM, CARD READER | NTS | B



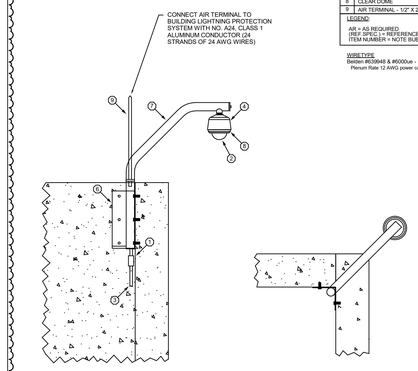
FOUNDATION DETAIL

TALK A PHONE #ETP-MT-R | NTS | C

Item	Description	Qty
1	2"x 4" J-BOX	1
2	PTZ CAMERA	1
3	CONDUIT TO ENVS	AR
4	ENVIRONMENTAL DOME ENCLOSURE	1
5	NOT USED	-
6	PARAPET MOUNT	1
7	PARAPET ARM	1
8	CLEAR DOME	1
9	AIR TERMINAL - 1/2" X 24"	1

LEGEND:
AR = AS REQUIRED
(REF SPEC.) => REFERENCE SPECIFICATIONS
ITEM NUMBER = NOTE BUBBLE

WIRETYPE
Belden #6GW45 & #6000ue - Plenum Rate Composite CCTV Cable + Plenum Rate 12 AWG power cable (Note: application good to 280')



TYPICAL EXTERIOR PTZ CAMERA DETAIL
PENDANT ADAPTER WITH PARAPET CORNER MOUNT | NTS | A

hGA.
1918 Main Street, Third Floor
Santa Monica , California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
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818-377-8220

ELECTRICAL ENGINEER
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949-756-0150

LABORATORY CONSULTANT
RESEARCH FACILITIES DESIGN
3965 FIFTH AVE. #400
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619-297-0159

SCIENCE CENTER
SANTA ANA COLLEGE

RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT

1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME, OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF CALIFORNIA

NAME:
DATE:
REGISTRATION NUMBER:

NO	DESCRIPTION	DATE
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

SECURITY ELECTRONICS DETAILS

DATE: JULY 06, 2017

SE4.04

ADDENDA PACKAGE

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Electronic Access Control System Schedule

SAC STEM (SE2-01)

Access Point	Device Number	Location	Reader Type	Mount Style	Wire Group	Notes	Door Detail	Priority
1	100A	NORTH ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ D	High
2	134A	ENGINEERING LAB-SC134	SMART CARD	MULLION	C		SE4.02/ B	High
3	134B	ENGINEERING LAB-SC134	LOCK ONLY	N/A	C		SE4.02/ G	High
4	115A	MULTI DISC COMPUTER LAB-SC115	SMART CARD	MULLION	C		SE4.02/ B	High
5	113-2A	LARGE CLASSROM-SC113-2	SMART CARD	MULLION	C		SE4.02/ B	High
6	132A	ENGINEERING PREP 7 STORAGE-SC132	SMART CARD	MULLION	C		SE4.02/ G	High
7	130A	MAIN ELECTRICAL ROOM	SMART CARD	N/A	C		SE4.03/ B	High
8	100B	SOUTH ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ B	High
9	295	GEOLOGY/PHYSICAL LAB & LECTURE-SC122	SMART CARD	MULLION	C		SE4.02/ B	High
10	122B	GEOLOGY/PHYSICAL LAB & LECTURE-SC122	LOCK ONLY	N/A	C		SE4.01/ H	High
11	113-1A	LARGE CLASSROM-SC113-1	SMART CARD	MULLION	C		SE4.02/ B	High
12	111-A	LARGE CLASSROM-SC111	LOCK ONLY	N/A	C		SE4.03/ A	High
13	111-B	LARGE CLASSROM-SC111	SMART CARD	MULLION	C		SE4.02/ B	High
14	120A	GEOLOGY/PHYSICAL-SC120	SMART CARD	WALL	C		SE4.01/ D	High
15	118A	GEOLOGY/PHYSICAL LAB & LECTURE-SC118	SMART CARD	MULLION	C		SE4.02/ B	High
16	118B	GEOLOGY/PHYSICAL LAB & LECTURE-SC118	LOCK ONLY	N/A	C		SE4.01/ H	High
17	109A	BDF-SC109	SMART CARD	WALL	C		SE4.02/ B	High
18	107A	MACHINE ROOM	SMART CARD	WALL	C		SE4.03/ B	High
19	105A	MAIN ENTRY DOOR	LOCK ONLY	N/A	C		SE4.03/ B	High
20	105B	MAIN ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ B	High
21	103A	SCIENCE LEARNING CENTER-SC103	SMART CARD	WALL	C		SE4.02/ B	High
22	307L	EXIT DOOR-SC103	SMART CARD	WALL	C		SE4.02/ B	High
23	114A	ELECTRICAL CLOSET	SMART CARD	WALL	C	1	SE4.03/ B	High
24	114B	ELECTRICAL CLOSET	SMART CARD	WALL	C	1	SE4.03/ B	High
25	116A	RECEPTION-SC116	SMART CARD	MULLION	C		SE4.02/ B	High
26	110A	VETIBULE-SC110	SMART CARD	WALL	C		SE4.02/ B	High
27	116-1A	OPEN OFFICE-SC110-1	SMART CARD	WALL	C		SE4.02/ B	High
28	116-1B	OFFICE-SC116-1	SMART CARD	WALL	C		SE4.02/ B	High
29	100-1A	EAST ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ D	High
30	SC001A	GREENHOUSE ENTRY DOOR	SMART CARD	WALL	C		SE4.0[illegible]/ F	High
31	SC001B	GREENHOUSE NORTH GATE	SMART CARD	WALL	C		SE4.04/ B	High
32	SC001C	GREENHOUSE SOUTH GATE	SMART CARD	WALL	C		SE4.04/ B	High

Wire Schedule

C	REFER TO CABLE ID LEGEND

Notes

GENERAL	25 CARD READERS
	5 ELECTRFIED LOCK
1	BOTH DOORS CONTROLLED BY ONE CARD READER

SAC STEM (SE2-02)

Access Point	Device Number	Location	Reader Type	Mount Style	Wire Group	Notes	Door Detail	Priority
1	200A	NORTH ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ D	High
2	226A	ORGANISMAL BIOLOGY LAB-SC226	SMART CARD	MULLION	C		SE4.01/ B	High
3	226B	ORGANISMAL BIOLOGY LAB-SC226	LOCK ONLY	N/A	C		SE4.02/ H	High
4	217A	ANATOMY LAB-SC217	SMART CARD	MULLION	C		SE4.01/ B	High
5	217B	ANATOMY LAB-SC217	LOCK ONLY	N/A	C		SE4.02/ H	High
6	222A	GENERAL & ORG PREP	SMART CARD	WALL	C		SE4.01/ B	High
7	218A	GENERAL BIOLOGY LAB-SC218	LOCK ONLY	N/A	C		SE4.02/ B	High
8	218B	GENERAL BIOLOGY LAB-SC218	SMART CARD	WALL	C		SE4.02/ H	High
9	216A	MICROBIOLOGY-SC216	LOCK ONLY	N/A	C		SE4.02/ H	High
10	216B	MICROBIOLOGY-SC216	SMART CARD	MULLION	C		SE4.01/ B	High
11	215A	ANATOMY PREPLAB-SC215	SMART CARD	MULLION	C		SE4.01/ B	High
12	213A	PHYSIOLOGY LAB-SC213	LOCK ONLY	N/A	C		SE4.02/ H	High
13	213B	PHYSIOLOGY LAB-SC213	SMART CARD	MULLION	C		SE4.01/ B	High
14	214A	MOLECULAR BIO PREP-SC214	SMART CARD	WALL	C		SE4.02/ D	High
15	212A	MOLECULAR BIO LAB-SC212	LOCK ONLY	N/A	C		SE4.02/ H	High
16	212B	MOLECULAR BIO LAB-SC212	SMART CARD	MULLION	C		SE4.01/ B	High
17	211A	IDF-SC211	SMART CARD	WALL	C		SE4.01/ B	High
18	201B	OFFICE-SC201	SMART CARD	WALL	C		SE4.01/ B	High
19	201-7A	OFFICE-SC201-7	SMART CARD	WALL	C		SE4.01/ B	High
20	201-6A	OFFICE-SC201-6	SMART CARD	WALL	C		SE4.01/ B	High
21	201-5A	OFFICE-SC201-5	SMART CARD	WALL	C		SE4.01/ B	High
22	201-4A	OFFICE-SC201-4	SMART CARD	WALL	C		SE4.01/ B	High
23	201-3A	OFFICE-SC201-3	SMART CARD	WALL	C		SE4.01/ B	High
24	201-2A	OFFICE-SC201-2	SMART CARD	WALL	C		SE4.01/ B	High
25	201-1A	OFFICE-SC201-1	SMART CARD	WALL	C		SE4.01/ B	High
26	201A	OFFICE-SC201	SMART CARD	WALL	C		SE4.01/ B	High
27	208A	CLASSROOM-SC208	SMART CARD	MULLION	C		SE4.01/ B	High
28	200-1A	EAST ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ D	High

Wire Schedule

C	REFER TO CABLE ID LEGEND

Notes

GENERAL	23 CARD READERS
	6 ELECTRFIED LOCK

SAC STEM (SE2-03)

Access Point	Device Number	Location	Reader Type	Mount Style	Wire Group	Notes	Door Detail	Priority
1	300A	NORTH ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ D	High
2	326A	CHEMISRTY LAB-SC326	SMART CARD	MULLION	C		SE4.02/ B	High
3	326B	CHEMISRTY LAB-SC326	LOCK ONLY	N/A	C		SE4.02/ H	High
4	315A	CHEMISRTY LAB-SC315	SMART CARD	MULLION	C		SE4.02/ B	High
5	315B	CHEMISRTY LAB-SC315	LOCK ONLY	N/A	C		SE4.02/ H	High
8	322B	CENTRALIZED PREP & STORAGE-SC322	SMART CARD	WALL	C		SE4.02/ D	High
9	320A	ORGANIC CHENISTRY LAB-SC320	SMART CARD	WALL	C		SE4.02/ B	High
10	320B	INSTRUMENT ROOM	SMART CARD	WALL	C		SE4.02/ B	High
11	318A	CHEMISTRY PREP & STORAGE-SC318	SMART CARD	WALL	C		SE4.02/ B	High
12	316A	CHEMISTY LAB-SC316	SMART CARD	MULLION	C		SE4.02/ B	High
13	316B	CHEMISTY LAB-SC316	LOCK ONLY	N/A	C		SE4.02/ H	High
14	311A	WASTE-SC311	SMART CARD	WALL	C		SE4.02/ B	High
15	313A	CHEMISTRY PREP & STORAGE-SC313	SMART CARD	WALL	C		SE4.02/ B	High
16	309A	CHEMISTY LAB-SC309	SMART CARD	MULLION	C		SE4.02/ B	High
17	309B	CHEMISTY LAB-SC309	LOCK ONLY	N/A	C		SE4.02/ H	High
18	314A	PHYSICS PREP & STORAGE	SMART CARD	WALL	C		SE4.02/ H	High
19	307A	IDF-SC307	SMART CARD	WALL	C		SE4.02/ B	High
20	312A	PHYSICS LAB-SC312	SMART CARD	MULLION	C		SE4.02/ B	High
21	312B	PHYSICS LAB-SC312	LOCK ONLY	N/A	C		SE4.02/ H	High
22	301B	OFFICE-SC301	SMART CARD	WALL	C		SE4.02/ B	High
23	301-7A	OFFICE-SC301-7	SMART CARD	WALL	C		SE4.02/ B	High
24	301-6A	OFFICE-SC301-6	SMART CARD	WALL	C		SE4.02/ B	High
25	301-5A	OFFICE-SC301-5	SMART CARD	WALL	C		SE4.02/ B	High
26	301-4A	OFFICE-SC301-4	SMART CARD	WALL	C		SE4.02/ B	High
27	301-3A	OFFICE-SC301-3	SMART CARD	WALL	C		SE4.02/ B	High
28	301-2A	OFFICE-SC301-2	SMART CARD	WALL	C		SE4.02/ B	High
29	301-1A	OFFICE-SC301-1	SMART CARD	WALL	C		SE4.02/ B	High
30	301A	OFFICE-SC301	SMART CARD	MULLION	C		SE4.02/ B	High
31	308A	CLASSROOM-SC308	SMART CARD	MULLION	C		SE4.02/ B	High
32	300B	EAST ENTRY DOOR	SMART CARD	WALL	C		SE4.01/ D	High

Wire Schedule

C	REFER TO CABLE ID LEGEND

Notes

GENERAL	26 CARD READERS
	5 ELECTRFIED LOCK

System Camera Schedule

SAC STEM CAMERA SCHEDULE

Camera Number	Device Number	Camera Type	Intended View	Drawing Number	Mount Style	Detail Number	Camera Height	Termination Point	Wire Group	Notes	Priority
1	SC001	Exterior Bullet IP Fixed	MAIN ENTRANCE LOBBY	SE2.01	Wall	SE4.02/ F	15'	Nearest TR	H		High
2	SC002	Exterior Surface/Flush MiniDome	NORTHEAST TO WEST	SE2.01	Surface	SE4.02/ G	N/A	Nearest TR	H		High
3	SC003	Exterior Surface/Flush MiniDome	NORTHEAST TO SOUTH	SE2.01	Surface	SE4.02/ G	N/A	Nearest TR	H		High
4	SC004	Exterior Surface/Flush MiniDome	EAST STAIRWAY	SE2.01	Surface	SE4.02/ G	N/A	Nearest TR	H		High
5	SC005	Exterior Bullet IP Fixed	SOUTHEAST TO WEST	SE2.01	Wall	SE4.02/ F	15'	Nearest TR	H		High
6	SC006	Exterior Surface/Flush MiniDome	SOUTHWEST TO EAST	SE2.01	Surface	SE4.02/ G	N/A	Nearest TR	H		High
7	SC007	Exterior Bullet IP Fixed	SOUTHWEST TO NORTH	SE2.01	Wall	SE4.02/ F	15	Nearest TR	H		High
8	SC008	Exterior Bullet IP Fixed	NORTHWEST TO SOUTH	SE2.01	Wall	SE4.02/ F	15	Nearest TR	H		High
9	SC009	Exterior Bullet IP Fixed	NORTHWEST TO EAST	SE2.01	Wall	SE4.02/ F	15'	Nearest TR	H		High
10	SC010	Exterior Bullet IP Fixed	NORTH STAIRWAY	SE2.01	Wall	SE4.02/ F	N/A	Nearest TR	H		High
11	SC011	Exterior Bullet IP Fixed	NORTHWEST TO MAIN ENTRANCE	SE2.01	Wall	SE4.02/ F	15	Nearest TR	H		High
12	SC012	Exterior Bullet IP Fixed	NORTHWEST GREENHOUSE	SE1.11	Wall	SE4.02/ F	N/A	Nearest TR	H		High
13	SC013	Exterior Bullet IP Fixed	SOUTHEAST GREENHOUSE	SE1.11	Wall	SE4.02/ F	N/A	Nearest TR	H		High
14	SC101	Interior Surface/Flush MiniDome	CORRIDOR SC100-1	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
15	SC102	Interior Surface/Flush MiniDome	EAST ENTRANCE	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
16	SC103	Interior Surface/Flush MiniDome	CORRIDOR-SC100-1	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
17	SC104	Interior Surface/Flush MiniDome	SOUTH ENTRANCE	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
18	SC105	Interior Surface/Flush MiniDome	CORRIDOR-SC100	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
19	SC106	Interior Surface/Flush MiniDome	NORTH ENTRANCE	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
20	SC201	Interior Surface/Flush MiniDome	CORRIDOR-SC207	SE2.02	Surface	SE4.01/ C	N/A	Nearest TR	H		High
21	SC202	Interior Surface/Flush MiniDome	ELEVATOR	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
22	SC203	Interior Surface/Flush MiniDome	EAST ENTRANCE	SE2.02	Surface	SE4.01/ C	N/A	Nearest TR	H		High
23	SC204	Exterior Surface/Flush MiniDome	EAST ENTRANCE (EXT)	SE2.02	Surface	SE4.01/ E	N/A	Nearest TR	H		High
24	SC205	Interior Surface/Flush MiniDome	CORRIDOR-SC200-1	SE2.02	Surface	SE4.01/ C	N/A	Nearest TR	H		High
25	SC206	Interior Surface/Flush MiniDome	SOUTH CORRIDOR	SE2.02	Surface	SE4.01/ C	N/A	Nearest TR	H		High
26	SC207	Interior Surface/Flush MiniDome	CORRIDOR-SC200-1	SE2.02	Surface	SE4.01/ C	N/A	Nearest TR	H		High
27	SC208	Interior Surface/Flush MiniDome	NORTH ENTRANCE	SE2.02	Surface	SE4.01/ C	N/A	Nearest TR	H		High
28	SC209	Exterior Surface/Flush MiniDome	NORTH ENTRANCE (EXT)	SE2.02	Surface	SE4.01/ E	N/A	Nearest TR	H		High
29	SC301	Interior Surface/Flush MiniDome	IDF AREA	SE2.03	Surface	SE4.01/ C	N/A	Nearest TR	H		High
30	SC302	Interior Surface/Flush MiniDome	ELEVATOR	SE2.01	Surface	SE4.01/ C	N/A	Nearest TR	H		High
31	SC303	Interior Surface/Flush MiniDome	EAST ENTRANCE	SE2.03	Surface	SE4.01/ C	N/A	Nearest TR	H		High
32	SC304	Exterior Surface/Flush MiniDome	EAST ENTRANCE (EXT)	SE2.03	Surface	SE4.01/ E	N/A	Nearest TR	H		High
33	SC305	Interior Surface/Flush MiniDome	CORRIDOR-SC300-1	SE2.03	Surface	SE4.01/ C	N/A	Nearest TR	H		High
34	SC306	Interior Surface/Flush MiniDome	SOUTH CORRIDOR	SE2.03	Surface	SE4.01/ C	N/A	Nearest TR	H		High
35	SC307	Interior Surface/Flush MiniDome	CORRIDOR-SC300-1	SE2.03	Surface	SE4.01/ C	N/A	Nearest TR	H		High
36	SC308	Interior Surface/Flush MiniDome	NORTH ENTRANCE	SE2.03	Surface	SE4.01/ C	N/A	Nearest TR	H		High
37	SC309	Exterior Surface/Flush MiniDome	NORTH ENTRANCE (EXT)	SE2.03	Surface	SE4.01/ E	N/A	Nearest TR	H		High

Wire Schedule

H	CAT6A

Notes

GENERAL	
1	
2	

HGA.
1918 Main Street, Third Floor
Santa Monica, California 90405
Telephone 310.557.7600

STRUCTURAL ENGINEER
SAIFUL BOUQUET
155 N LAKE AVE
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626-304-2616

MECHANICAL & PLUMBING ENGINEER
STANTEC CONSULTING INC
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150 PAULARINO AVE. #A120
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LOS ANGELES, CA 90017
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3965 FIFTH AVE. #400
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SCIENCE CENTER
SANTA ANA COLLEGE
RANCHO SANTIAGO COMMUNITY COLLEGE DISTRICT
1530 W. 17TH ST.
SANTA ANA, CA 92706

SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF

LICENSED ARCHITECT JAMES G. MATSON C-13036 SEPTEMBER 30, 2017 RENEWAL DATE STATE OF CALIFORNIA

NAME:
DATE:
REGISTRATION NUMBER:

NO	DESCRIPTION	DATE
2	ADDENDUM 2	09/01/2017
3	ADDENDUM 3	09/22/2017

ISSUANCE HISTORY - THIS SHEET

DRAWN BY: Author | REVIEW BY: Approver

HGA NO: 3584-001-00

SECURITY ELECTRONICS ACCESS CTRL. AND CAMERA SCHEDULES

DATE: JULY 06, 2017

SE5.01

ADDENDA PACKAGE

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Author 9/20/2017 4:11:51 PM C:\Users\ainlong\Documents\Revit Projects\2016\GP-Security-Santa Ana College_ainlong.rvt

PROJECT INFORMATION FROM SHEET A09

PROJECT NAME: SANTA ANA COLLEGE | SCIENCE CENTER

PROJECT DESCRIPTION:
NEW 3 STORY SCIENCE BUILDING W/ LABORATORIES, CLASSROOMS, LECTURE SPACES, STUDY SPACES, & OFFICES

OCCUPANCY: B — **MIXED OCCUPANCY**: A-3
PROPOSED USE: SCIENCE LABS, CLASSROOMS, OFFICES — **SEISMIC ZONE**: 4
PROJECT ADDRESS:
SANTA ANA COLLEGE
1530 S. 17TH ST., SANTA ANA, CA 92706

REQUIRED FIRE SEPARATION: — **TYPE OF CONSTRUCTION**: II-B
1-HOUR SEPARATION GROUP A-3 AND GROUP B OCCUPANCIES,
1-HOUR SHAFT ENCLOSURES
1-HOUR STAIRWAY CONSTRUCTION
2-HOUR FLOOR AND 1-HOUR WALL SEPARATING CONTROL AREAS

HEIGHT OF NEW BUILDING: 56'-0"
PROJECT FLOOR AREA: 65,500 GSF

CONTACT INFORMATION

OWNER: RSCCD	CONTACT: ALLISON COBURN	PHONE: (714) 480-7510
CIVIL ENGINEER: KPFF Consulting Engineers	CONTACT: Reza Rezaian	PHONE: (310) 665-5239
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SECURITY: Guidepost Solutions	CONTACT: Michael Niola	PHONE: (213) 624-9000
SIGNAGE: Davies Associates	CONTACT: Noel Davies	PHONE: (310) 247-9572

FIRE PROTECTION INFORMATION

FIRE DISTRICT: ORANGE COUNTY FIRE DEPARTMENT
FIRE EXTINGUISHING SYSTEM: AUTOMATIC SPRINKLER SYSTEM (LIGHT HAZARD, ORDINARY HAZARD GROUP 1 & ORDINARY HAZARD GROUP 2)
STANDPIPE SYSTEM: CLASS 1
SMOKE CONTROL: N/A — SMOKE AND HEAT VENTS: N/A
OCCUPANT LOAD: 1,056 PERSONS — NUMBER OF EXITS REQUIRED: 2 EXITS PER FLOOR
REQUIRED EXIT WIDTH: 32" DOORS & 44" STAIRS — MAXIMUM TRAVEL DISTANCE ALLOWED: GROUP A-3 = 250 FEET & GROUP B = 300 FEET
MAXIMUM COMMON PATH DISTANCE ALLOWED: GROUP A-3 = 75 FEET & GROUP B = 100 FEET

GENERAL BUILDING LIMITATIONS

ALLOWABLE FLOOR AREA: 23,000 SF
AREA INCREASES: 207,000 SF W/ AUTO FIRE SPRINKLER — CODE REFERENCE: CBC 506.4.1
MAXIMUM HEIGHT OF BUILDING: 56 SF — MAXIMUM NUMBER OF STORIES: 3
HEIGHT INCREASES: 20 FT & (1) STORY W/ AUTOMATIC FIRE SPRINKLER

RATING REQUIREMENTS

BEARING WALLS - EXTERIOR	0
BEARING WALLS - INTERIOR	0
NONBEARING WALLS - EXTERIOR	0
STRUCTURAL FRAME	0
PARTITIONS PERMANENT	0
SHAFT ENCLOSURES	1 HR
FLOORS AND FLOOR CEILINGS	1 HR
ROOFS AND ROOF CEILINGS	0
EXTERIOR DOORS AND WINDOWS	0
STAIRWAY CONSTRUCTION	1 HR

SPRINKLER LEGEND

Count	Symbol	Manufacturer	Model	Description	K-Factor	Temperature Rating	Coverage	Finish
LEVEL 01								
52	○	VIKING	VK300	Q.R. UPRIGHT	5.6	155 °F	Standard	BRASS
155	⦿	VIKING	VK302	Q.R. PENDENT	5.6	155 °F	Standard	WHITE
5	▷	VIKING	VK305	Q.R. SIDEWALL	5.6	155 °F	Standard	WHITE
11	⊗	VIKING	VK350	Q.R. UPRIGHT	8	155 °F	Standard	BRASS
13	⦿	VIKING	VK352	Q.R. PENDENT	8	155 °F	Standard	WHITE
236								
LEVEL 02								
11	○	VIKING	VK300	Q.R. UPRIGHT	5.6	155 °F	Standard	BRASS
208	⦿	VIKING	VK302	Q.R. PENDENT	5.6	155 °F	Standard	WHITE
1	▷	VIKING	VK305	Q.R. SIDEWALL	5.6	155 °F	Standard	WHITE
220								
LEVEL 03								
11	○	VIKING	VK300	Q.R. UPRIGHT	5.6	155 °F	Standard	BRASS
135	⦿	VIKING	VK302	Q.R. PENDENT	5.6	155 °F	Standard	WHITE
1	▷	VIKING	VK305	Q.R. SIDEWALL	5.6	155 °F	Standard	WHITE
92	⦿	VIKING	VK352	Q.R. PENDENT	8	155 °F	Standard	WHITE
239								

693 PROJECT TOTAL

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FIRE PROTECTION GENERAL NOTES

THE AUTOMATIC SPRINKLER SYSTEM POINT OF CONNECTION WILL BE 6 INCHES ABOVE FINISH FLOOR WITHIN THE INTERIOR OF THE BUILDING.

1. FIRE PROTECTION SYSTEM SHALL COMPLY WITH 2013 NFPA 13, 2013 NFPA 14, 2013 NFPA 24, PROJECT SPECIFICATIONS AND ALL APPLICABLE STATE AND LOCAL CODES.
2. INSTALLING CONTRACTOR SHALL OBTAIN ALL PERMITS AND LICENSES.
3. DESIGN & INSTALLATION SUBJECT TO FINAL INSPECTION AND APPROVAL BY DSA PROJECT INSPECTOR AND ARCHITECT/ENGINEER.
4. CUTTING OF STRUCTURAL AND/OR ARCHITECTURAL MEMBERS SHALL BE DONE ONLY WITH THE WRITTEN APPROVAL OF THE ARCHITECT.
5. PIPE ROUTING SHOWN SHALL BE USED AND ANY ADDITIONAL OFFSETS OR FITTINGS REQUIRED FOR PROPER INSTALLATION, COORDINATION WITH OTHER TRADES, AND/OR TO MAINTAIN PROPER CLEARANCES SHALL BE APPROVED BY DSA AND PROVIDED BY THE INSTALLING CONTRACTOR AT NO ADDITIONAL COST. VERIFY EXISTING STRUCTURAL, MECHANICAL, ELECTRICAL INSTALLATIONS AND AVOID ANY/ALL OBSTRUCTIONS OR INTERFERENCES OF FIRE PROTECTION PIPE ROUTING.
6. FIRE STOP ALL PENETRATIONS OF SMOKE/FIRE WALLS, RATED WALLS, CEILINGS, FLOORS, ROOFS, ETC. FLASH AND COUNTERFLASH ROOF PENETRATIONS.
7. PROVIDE ACCESS PANELS TO ALL VALVES ABOVE NON-ACCESSIBLE CEILINGS AND CHASES.
8. SPRINKLERS SHALL BE COORDINATED WITH ALL DIFFUSERS, SPEAKERS, LIGHTING FIXTURES AND CEILING SYSTEMS.
9. METHODS OF HANGING PIPES, HEADERS AND BRANCHES SHALL BE IN ACCORDANCE WITH 2013 NFPA 13.
10. ALL BRACING SHALL BE ATTACHED TO THE BUILDING'S STRUCTURAL FRAME IN ACCORDANCE WITH 2013 NFPA 13.
11. AUTOMATIC SPRINKLER TEMPERATURE RATINGS OF FUSIBLE ELEMENTS SHALL BE IN ACCORDANCE WITH 2013 NFPA 13.
12. ALL VALVES FOR FIRE SERVICE SHALL BE LISTED BY THE UNDERWRITER'S LABORATORIES, INC. AND/OR THE FACTORY MUTUAL LABORATORIES. VALVES SHALL BE FACTORY MARKED "UL" AND "FM", 175 PSI WORKING PRESSURE.
13. SPRINKLER PIPE SHALL BE SCHEDULE 40 FOR 1"-2" AND SCHEDULE 10 FOR 2 1/2" AND LARGER.
14. ONLY NEW MATERIALS SHALL BE USED IN THE INSTALLATION OF THIS SYSTEM.
15. ALL FIRE SPRINKLERS MOUNTED IN CEILING SHALL BE LOCATED A MINIMUM OF 4" AWAY FROM ANY WALLS, CEILING HEIGHT CHANGES OR ANY OTHER VERTICAL INTERSECTING SURFACE. SPRINKLERS SHALL BE LOCATED AT CENTER OF TILE.
16. PIPE DRAINS TO OUTSIDE LOCATION TO BE APPROVED BY OWNER.
17. INSTALL EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
18. ALL SPRINKLER AND FIRE PROTECTION PIPING SHALL BE PRIMED FOR PAINTING.
19. INSTALL PRESSURE GAUGE ON THE RISER AND/OR AT EACH TEST CONNECTION. PROVIDE GAUGE WITH A CONNECTION NOT LESS THAN 1/4" AND HAVING A SOFT METAL SEATED GLOBE VALVE. TEST CONNECTIONS MAY ALSO SERVE AS DRAIN PIPES.
20. ROD STIFFENER REQUIRED FOR ALL-THREAD-ROD HANGERS AS REQUIRED PER NFPA 13.
21. INSTALL UNIONS IN PIPES 2" AND SMALLER, ADJACENT TO EACH VALVE. UNIONS ARE NOT REQUIRED ON FLANGED DEVICES OR IN PIPING INSTALLATIONS USING GROOVED MECHANICAL COUPLINGS.
22. THE UNDERGROUND PIPING PLANS AND OTHER WATER SUPPLY COMPONENTS, SUCH AS WATER TANKS FIRE PUMPS, ETC., FOR THE PROJECT SHALL MATCH THE AUTOMATIC FIRE SPRINKLER SUBMITTAL. ALL DEVIATIONS OF THE APPROVED PLANS SHALL BE JUSTIFIED AND SUBMITTED TO DSA VIA THE CHANGE ORDER PROCESS AS APPLICABLE.
23. UNDERGROUND PIPING SIZE IS NOT THE RESPONSIBILITY OF DSA AND THE CIVIL DESIGNER TAKES FULL LIABILITY FOR UNDERSIZED PIPING.
24. 2013 NFPA 13 SEC. 10.10.2.1.1 UNDERGROUND MAINS AND LEAD-IN CONNECTIONS TO SYSTEM RISERS SHALL BE COMPLETELY FLUSHED BEFORE CONNECTION IS MADE TO OVERHEAD SPRINKLER PIPING. WHERE UNDERGROUND PIPING IS FLUSHED AND NOT IMMEDIATELY CONNECTED TO THE OVERHEAD PIPING, THE RISER SHALL BE CAPPED OR OTHERWISE PROTECTED TO PREVENT DEBRIS, DIRT, OR ANIMALS FROM ENTERING THE UNDERGROUND PIPING (WITNESSED BY THE PROJECT INSPECTOR).
25. PROVIDE FLOW TEST DATA AND INDICATE THE LOCATIONS AND HEIGHT ELEVATIONS OF THE TEST AND RESIDUAL FLOW HYDRANTS. DATA MUST BE NO MORE THAN 6 MONTHS OLD AND PROVIDE INFORMATION MAY COME FROM THE LOCAL WATER PURVEYOR, UTILITIES COMPANY, OR LOCAL FIRE DEPARTMENT. THIS INFORMATION SHALL BE ACCOMPANIED WITH A WET SIGNATURE AND SIGNED DATE OF TEST.
26. ARCHITECT OF RECORD, FIRE PROTECTION ENGINEER OR MECHANICAL ENGINEER SHALL AFFIX THEIR SEAL AND STAMP & SIGN ALL SUBMITTAL DRAWINGS, OR PROVIDE DOCUMENTATION PER CALIFORNIA STATE LICENSING BOARD REGULATIONS.
27. 2013 NFPA 13 SECTION 10.10.2.2.1: ALL PIPING AND ATTACHED APPURTENANCES SUBJECTED TO SYSTEM WORKING PRESSURE SHALL BE HYDROSTATICALLY TESTED AT 200 PSI, OR 50 PSI IN EXCESS OF THE SYSTEM WORKING PRESSURE, WHICHEVER IS GREATER, AND SHALL MAINTAIN THAT PRESSURE WITHOUT LOSS FOR 2 HOURS. (PROJECT INSPECTOR SHALL WITNESS AND CONFIRM COMPLIANCE).
28. 2013 NFPA 13 SEC. 6.2.9: PROVIDE SPARE SPRINKLER HEAD CABINET, SPRINKLER WRENCH, AND NO FEWER THAN SIX (6) SPARE SPRINKLER HEADS MATCHING THE TYPES AND TEMPERATURE RATING IN EACH PROTECTED AREA FOR SYSTEMS HAVING LESS THAN 300 SPRINKLERS. (NO FEWER THAN 12 SPARE SPRINKLER HEADS FOR SYSTEMS HAVING 300-1,000 SPRINKLERS).

SHEET INDEX

SHEET NUMBER	SHEET NAME
FP-001	GENERAL NOTES
FP-100	REFERENCE SITE PLAN
FP-201	FIRE SPRINKLER PIPING PLAN - LEVEL 01
FP-202	FIRE SPRINKLER PIPING PLAN - LEVEL 02
FP-203	FIRE SPRINKLER PIPING PLAN - LEVEL 03
FP-204	FIRE SPRINKLER PIPING PLAN - ROOF
FP-301	FIRE SPRINKLER RCP - LEVEL 01
FP-302	FIRE SPRINKLER RCP - LEVEL 02
FP-303	FIRE SPRINKLER RCP - LEVEL 03
FP-400	BUILDING SECTIONS
FP-500	STANDPIPE DETAILS
FP-501	HANGERS AND PIPING DETAILS
FP-502	SEISMIC BRACING DETAILS
FP-503	STANDPIPE ISOMETRICS

FIRE PROTECTION GENERAL NOTES

29. 2013 NFPA 13 SEC. 9.3.6.3: THE END SPRINKLER ON EACH LINE SHALL BE RESTRAINED.
30. 2013 CBC 903.4.2 AND 2013 NFPA 13: THE INSPECTOR'S TEST VALVE SHALL BE INSTALLED DOWNSTREAM OF THE WATERFLOW ALARM DEVICE, USING A PIPE SIZE OF NO LESS THAN 1 INCH, WITH A SMOOTH BORE, CORROSION RESISTANT ORIFICE, GIVING THE FLOW EQUIVALENT TO ONE SPRINKLER OF A TYPE HAVING THE SMALLEST ORIFICE INSTALLED WITHIN THE SYSTEM. THE DISCHARGE SHALL BE TO THE EXTERIOR OF THE BUILDING.
31. 2013 CBC 904.4.3: CONNECTIONS TO PROTECTED PREMISES AND SUPERVISING STATION FIRE ALARM SYSTEMS SHALL BE TESTED TO VERIFY PROPER IDENTIFICATION AND TRANSMISSION OF ALARMS FROM AUTOMATIC FIRE EXTINGUISHING SYSTEMS.
32. 2013 NFPA 13 SEC. 8.17.2.4.7: SIGNAGE SHALL BE PROVIDED AS REQUIRED.
33. 2013 CBC SEC. 903.4.1: ALL VALVES CONTROLLING THE WATER SUPPLY FOR AUTOMATIC SPRINKLER SYSTEMS, PUMPS, TANKS, WATER LEVELS AND TEMPERATURES, CRITICAL AIR PRESSURES AND WATER FLOW SWITCHES ON ALL SPRINKLER SYSTEMS SHALL BE SUPERVISED AND SHALL BE THE RESPONSIBILITY OF THE FIRE SPRINKLER CONTRACTOR.
34. 2013 NFPA 13 SEC. 25.5: A PERMANENTLY ATTACHED HYDRAULIC NAME PLATE STATING THE REQUIRED DESIGN CRITERIA FOR EACH HYDRAULICALLY DESIGNED SYSTEM SHALL BE ATTACHED TO EACH RISER.
35. 2013 NFPA 13 SEC. 6.9.3.1, 6.9.4 AND 2013 CBC 903.4.2: FLOW SWITCH SHALL BE CONNECTED TO A 10 INCH OUTSIDE ALARM BELL AT EACH RISER. APPROVED IDENTIFICATION SIGNS SHALL BE PROVIDED TO OUTSIDE ALARM BELL "SPRINKLER FIRE ALARM - WHEN BELL RINGS CALL 911 / FIRE DEPARTMENT.
36. TITLE 19 ARTICLE 906(a): A LABEL OF THE SELF-ADHESIVE TYPE SHALL BE PLACED ON THE FIRE DEPARTMENT CONNECTION OR ON THE RISER FOR FIRE SPRINKLER SYSTEM WITH THE DATE OF SERVICE AND / OR DATE OF INSTALLATION WAS PREFORMED AND LICENSE NUMBER OF PERSON PERFORMING SERVICE WORK.
37. 2013 NFPA 13 FIGURE 10.10.1: A COPY OF COMPLETED AND SIGNED "CONTRACTOR'S MATERIALS & TEST CERTIFICATE FOR UNDERGROUND PIPING" SHALL BE PROVIDED TO THE PROJECT INSPECTOR.
38. 2013 NFPA: SPRINKLER CONTRACTOR SHALL COMPLETE AND SIGN CONTRACTOR'S MATERIAL & TEST CERTIFICATE FOR THE ABOVE GROUND PIPING. THIS FORM SHALL BE GIVEN TO THE PROJECT INSPECTOR WHO WILL FORWARD TO DSA FOR FILING IN PROJECT RECORDS.
39. 2013 CFC 901.2.1 - REQUEST FOR FINAL APPROVAL OF INSTALLATION SHALL INCLUDE WRITTEN STATEMENT OF COMPLIANCE, FROM INSTALLING CONTRACTOR.
40. 2013 CFC 901.5.1 - OCCUPANCY IS PROHIBITED UNTIL FIRE SPRINKLER SYSTEM HAS BEEN TESTED AND APPROVED.
41. 2013 CFC 901.6.2 - RECORD (AS-BUILT) DRAWINGS SHALL BE MAINTAINED ON THE PREMISES FOR A MINIMUM OF THREE YEARS.
42. ALL INDICATED PIPE AND SPRINKLER ELEVATIONS ARE APPROXIMATE IN NATURE. THE CONTRACTOR SHALL FIELD VERIFY ALL SPRINKLER COMPONENTS AND THEIR ASSOCIATED ELEVATIONS PRIOR TO SYSTEM INSTALLATION.
43. (3) BASED ON A FLOW TEST PERFORMED ON AUGUST 2ND, 2016 BY ORANGE COUNTY FIRE PROTECTION, IT WAS DETERMINED THAT THE UNDERGROUND FIRE WATER SYSTEM HAS A STATIC PRESSURE OF 62 PSI, AND A RESIDUAL PRESSURE OF 54 PSI, WITH A FLOW OF 1,775 GPM. THE AUTOMATIC SPRINKLER SYSTEM HAS BEEN DESIGNED WITH A 10% SAFETY FACTOR APPLIED TO THE REPORTED FLOW TEST DATA (SEE SHEET FP1.00 AND HYDRAULIC CALCULATIONS).
44. 2013 NFPA 72 - CONNECTIONS TO PROTECTED PREMISES AND SUPERVISING STATION FIRE ALARM SYSTEMS SHALL BE TESTED TO VERIFY RECEIPT OF TRANSMISSION OF ALARMS FROM AUTOMATIC FIRE EXTINGUISHER SYSTEMS WITHIN 90 SECONDS OF INITIATION (WITNESSED BY PROJECT INSPECTOR).
45. 2006 NFPA 25 CALIFORNIA EDITION - A WATERFLOW ALARM TEST SHALL BE CONDUCTED BY OPENING THE INSPECTOR'S TEST VALVE OR ALARM BYPASS VALVE. AN AUDIBLE DEVICE MUST ACTIVATE WITHIN 90 SECONDS OF VALVE OPENING. (WITNESSED BY PROJECT INSPECTOR).
46. IT IS THE CONTRACTOR'S RESPONSIBILITY TO RECEIVE APPROVAL OF ANY CHANGES FROM THE DESIGN DRAWINGS DEEMED "MINOR CHANGES" AS OUTLINED IN SECTION 4.3.2 OF DSA POLICY PL 10-01 USING THE DSA CHANGE ORDER PROCESS AND APPROPRIATE ADDENDA. FOR CHANGES TO THE DESIGN DRAWINGS WHICH ALTER THE DESIGN OF THE SYSTEM AND REQUIRE A FIELD CHANGE DOCUMENT (FCD) TO BE PREPARED, THE PREPARATION OF THE FCD SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND REVIEW WILL BE PROVIDED BY THE ENGINEER OF RECORD. CHANGES OR MODIFICATIONS WHICH DO NOT MODIFY THE DESIGN OF THE SYSTEM (SUCH AS ADDITION OF BRACING OR CHANGES IN SPECIFIED MATERIAL) SHALL BE ADDRESSED USING A DSA CHANGE ORDER AND SHALL REQUIRE APPROVAL OF THE OWNER.
47. SIGNAGE SHALL BE PROVIDED AT THE FIRE DEPARTMENT CONNECTION IN ACCORDANCE WITH CFC 912.4 AND 2013 NFPA 13 SECTION 8.17.2.4.7.1.
48. PROVIDE IDENTIFICATION SIGNAGE AT FIRE PROTECTION EQUIPMENT IN ACCORDANCE WITH CFC 509.1.
49. 2013 NFPA 13 SECTION 9.2.1.3.3.4 - WHERE FLEXIBLE SPRINKLER HOSE FITTINGS ARE USED TO CONNECT SPRINKLERS TO BRANCH LINES IN SUSPENDED CEILINGS, A LABEL LIMITING RELOCATION OF THE SPRINKLER SHALL BE PROVIDED ON THE ANCHORING COMPONENT.
50. PENETRATIONS THROUGH THE CEILING FOR SPRINKLERS THAT ARE NOT INTEGRALLY TIED TO THE CEILING SYSTEM IN THE LATERAL DIRECTION SHALL HAVE A TWO (2) INCH OVERSIZED RING, SLEEVE OR ADAPTER THROUGH THE CEILING TILE TO ALLOW FREE MOVEMENT OF ONE (1) INCH IN ALL HORIZONTAL DIRECTIONS PER ASTM E580.

Revised: July 18, 2016

MEP Component Anchorage Note
All mechanical, plumbing, and electrical components shall be anchored and installed per the details on the DSA approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacement requirements prescribed in the 2013 CBC, Sections 1616A.1.18 through 1616A.1.26 and ASCE 7-10 Chapter 13, 26 and 30.

1. All permanent equipment and components.
2. Temporary or movable equipment that is permanently attached (e.g. hard wired) to the building utility services such as electricity, gas or water.
3. Movable equipment which is stationed in one place for more than 8 hours and heavier than 400 pounds are required to be anchored with temporary attachments.

The following mechanical and electrical components shall be positively attached to the structure, but the attachment need not be detailed on the plans. These components shall have flexible connections provided between the component and associated ductwork, piping, and conduit.

A. Components weighing less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the component.
B. Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

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 responsible charge or structural engineer delegated responsibility and the DSA District Structural Engineer. The project inspector will verify that all components and equipment have been anchored in accordance with above requirements.

Piping, Ductwork, and Electrical Distribution System Bracing Note
Piping, ductwork, and electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7-10 Section 13.3 as defined in ASCE 7-10 Section 13.6.5.6, 13.6.7, 13.6.8, and 2013 CBC, Sections 1616A.1.23, 1616A.1.24, 1616A.1.25 and 1616A.1.26.

The method of showing bracing and attachments to the structure for the identified distribution system are as noted below. When bracing and attachments are based on a preapproved installation guide (e.g., SMACNA or OSHPD OPM), copies of the bracing system installation guide or manual shall be available on the jobsite prior to the start of and during the hanging and bracing of the distribution systems. The Structural Engineer of Record shall verify the adequacy of the structure to support the hanger and brace loads.

Mechanical Piping (MP), Mechanical Ducts (MD), Plumbing Piping (PP), Electrical Distribution Systems (E):

MP☐ MD☐ PP☐ E☐ - Option 1: Detailed on the approved drawings with project specific notes and details. (X)

MP☐ MD☐ PP☐ E☐ - Option 2: Shall comply with the applicable OSHPD Pre-Approval (OPM #) #0052-13.

MP☐ MD☐ PP☐ - 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 detailed on the approved drawings with project specific notes and details. The details shall account for the applicable Seismic Hazard Level _____ and Connection Level _____ for the project and conditions.

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SANTA ANA COLLEGE

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF CALIFORNIA

LICENSED ARCHITECT — JAMES G. MATSON — C 23036 — SEPTEMBER 30, 2017 RENEWAL DATE — STATE OF CALIFORNIA

NAME: Piyawat Vorapani
DATE: 07/06/2017
REGISTRATION NUMBER: FP 1658

△ NO	DESCRIPTION	DATE
1	Addendum 1	8/11/17
2	Addendum 2	9/01/17
3	Addendum 3	9/22/17

ISSUANCE HISTORY - THIS SHEET
DRAWN BY: MCL — REVIEW BY: YOK

HGA NO: 3584-001-00

GENERAL NOTES

DATE: JULY 06, 2017

ADDENDA PACKAGE

FP-001

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