

DIVISION 2 – EXISTING CONDITIONS

SECTION 024119 SELECTIVE DEMOLITION

DIVISION 3 – CONCRETE

SECTION 033000 CAST-IN-PLACE CONCRETE

DIVISION 5 – METALS

SECTION 051200 STRUCTURAL STEEL FRAMING

SECTION 055000 METAL FABRICATIONS

SECTION 055213 PIPE AND TUBE RAILINGS

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 078100 APPLIED FIREPROOFING

SECTION 079200 23 JOINT SEALANTS

DIVISION 8 – OPENINGS

SECTION 081113 HOLLOW METAL DOORS AND FRAMES

SECTION 084229 SLIDING AUTOMATIC ENTRANCES

SECTION 087100 DOOR HARDWARE

SECTION 088000 GLAZING

DIVISION 9 – FINISHES

SECTION 093000 TILING

SECTION 095100 ACOUSTICAL CEILINGS

SECTION 096550 RESILIENT FLOORING

SECTION 099000 PAINTING AND COATING

DIVISION 26 – ELECTRICAL

SECTION 260000 GENERAL ELECTRICAL REQUIREMENTS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 283111 DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Items indicated to be removed and salvaged remain Owner's property. Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner[**ready for reuse**]. Include fasteners or brackets needed for reattachment elsewhere.
- B. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements. Submit before Work begins.
- C. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- D. It is not expected that hazardous materials will be encountered in the Work. If hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with EPA regulations and with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Before proceeding with demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of the building.
- B. Locate, identify, shut off, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.
- D. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- E. Protect walls, ceilings, floors, and other existing finish work that are to remain. Erect and maintain dustproof partitions. Cover and protect furniture, furnishings, and equipment that have not been removed.
- F. Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- G. Provide temporary weather protection to prevent water leakage and damage to structure and interior areas.
- H. Requirements for Building Reuse:
 - 1. Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
 - 2. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
- I. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
- J. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill. Do not burn demolished materials.
- K. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data, concrete mix designs, and submittals required by ACI 301.
- B. Ready-Mixed Concrete Producer Qualifications: ASTM C 94/C 94M.

1.2 PERFORMANCE REQUIREMENTS

- A. Synthetic Fiber: ASTM C 1116/C 1116M, Type III, polypropylene fibers, 1/2 to 1-1/2 inches (13 to 38 mm) long.
- B. Vapor Retarder: Reinforced sheet, ASTM E 1745, Class A. See Section 07260 Reinforced Vapor Retarders for Under Slabs.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

PART 2 - EXECUTION

2.1 CONCRETING

- A. Construct formwork according to ACI 301 and maintain tolerances and surface irregularities within ACI 347R limits of Class A, 1/8 inch (3.2 mm) for concrete exposed to view and Class C, 1/2 inch (13 mm) for other concrete surfaces.
- B. Place vapor retarder on prepared subgrade, with joints lapped 6 inches (150 mm) and sealed.
- C. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- D. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at isolation joints.
- E. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.

- F. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.
- G. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.
- H. Slab Finishes: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Provide the following finishes:
 - 1. Scratch finish for surfaces to receive mortar setting beds.
 - 2. Float finish for surfaces to receive waterproofing, roofing, or other direct-applied material.
 - 3. Troweled finish for floor surfaces and floors to receive floor coverings, paint, or other thin film-finish coatings.
 - 4. Trowel and fine-broom finish for surfaces to receive thin-set tile.
 - 5. Nonslip-broom finish to exterior concrete platforms, steps, and ramps.
- I. Cure formed surfaces by moisture curing for at least seven days.
- J. Begin curing concrete slabs after finishing. Keep concrete continuously moist for at least seven days.
- K. Owner will engage a testing agency to perform field tests and to submit test reports.
- L. Protect concrete from damage. Repair and patch defective areas.

END OF SECTION 03300

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Structural steel.
2. Grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified California licensed professional engineer responsible for their preparation.
6. Do not proceed with fabrication of steel until University's Representative reviews shop drawings. University review of shop drawings will be for general concept and design and character of details, not for accuracy of dimensions. A maximum submission of 60 structural steel shop drawings will be reviewed in any 15-working day period. Larger submittals will require additional review time.
7. Direct copies of the Contract Documents will not be accepted as a submission.

C. Welding certificates.

D. Qualification Data: For qualified Installer, fabricator, and testing agency.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

F. Source quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ASCE.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement [P1] [P2] [P3] or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- B. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 341 and AISC 341s1.
 3. AISC 360.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angle Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M unless noted otherwise.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Weight Class: Standard unless noted otherwise.
 - 2. Finish: Black except where indicated to be galvanized.
- G. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.

- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. Unheaded Anchor Rods: ASTM F 1554, Grade 36, UNO.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- G. Headed Anchor Rods: ASTM F 1554, Grade 36 (UNO), straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 4. Finish: Plain
- H. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened.
 - 3. Finish: Plain.
- I. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.3 PRIMER

- A. Primer: SSPC-Paint 25, Type I, iron oxide, zinc oxide, raw linseed oil, and alkyd.
- B. Primer: SSPC-Paint 25 BCS, Type I, iron oxide, zinc oxide, raw linseed oil, and alkyd.
- C. Primer: SSPC-Paint 23, latex primer.
- D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- E. Galvanizing Repair Paint: **ASTM A 780**.

2.4 GROUT

- A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
 - 5. Provide for attachment of work to structural steel.
- B. Thermal Cutting: Thermal cutting is subject to approval from University's Representative. Perform thermal cutting, when so approved, by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- A. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning, with SSPC-SP 2, "Hand Tool Cleaning, or SSPC-SP 3, "Power Tool Cleaning" as required.
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- C. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- D. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches o.c., unless otherwise indicated.

- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: [**Snug tightened**] [**Pretensioned**] [**Slip critical**].
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

- D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.

2.9 SOURCE QUALITY CONTROL

- A. University will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by University's Representative. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened
 - 2. Orient bolt heads in same direction on architecturally exposed structural steel.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: University may engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections if applicable.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories and abutting structural steel.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 Section "High-Performance Coatings".

END OF SECTION 051200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings.

PART 2 - PRODUCTS

2.1 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Steel Tubing: ASTM A 500.
- D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.
- E. Cast Iron: ASTM A 48/A 48M or ASTM A 47/A 47M.
- F. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003-H14.
- G. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- H. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.2 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.3 FABRICATION

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.

1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Type 1 welds: no evidence of a welded joint]** **[Type 2 welds: completely sanded joint, some undercutting and pinholes okay]** **[Type 3 welds: partially dressed weld with spatter removed]** **[Type 4 welds: good quality, uniform undressed weld with minimal splatter]**.
- C. Comply with AWS for recommended practices in shop brazing. Braze behind finished surfaces without distorting or discoloring exposed side. Clean exposed brazed joints of flux, and dress exposed and contact surfaces.
1. Where brazing cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Type 1 welds: no evidence of a welded joint]** **[Type 2 welds: completely sanded joint, some undercutting and pinholes okay]** **[Type 3 welds: partially dressed weld with spatter removed]** **[Type 4 welds: good quality, uniform undressed weld with minimal splatter]**.
- D. On units indicated to be cast into concrete or built into masonry, provide welded steel strap anchors, **1/8 by 1-1/2 inches (3.2 by 38 mm)**, with a minimum **6-inch (150-mm)** embedment and **2-inch (50-mm)** hook, not less than **8 inches (200 mm)** from ends and corners of units and **24 inches (600 mm)** o.c.
- E. Fabricate nosings from cast **[iron]** **[aluminum]** with an integral abrasive finish.
1. Manufacturers: **[One of the following:]**
 - a. Amstep Products
 - b. Balco Inc.
 - c. Wooster Products Inc.
 2. Apply bituminous paint to concealed surfaces of units set into concrete.
- F. Fabricate perforated sheet metal panel **(for interior soffit)**:
1. Manufacturers: **[One of the following:]**
 - a. McNichols Co., Inc.
 - b. Ametco Manufacturing Corporation
 - c. Marco Specialty Steel, Inc.
 2. Mill finish, 20 gauge, 1/4" round hole, 1" centers to centers, straight pattern.
- G. Fabricate perforated sheet metal panel **(for exterior guard panel assemblies)**:
1. Manufacturers: **[One of the following:]**
 - a. Hendrick Manufacturing
 - b. Marco Specialty Steel, Inc.
 - c. Remaly Manufacturing Company, Inc.
 2. Mill finish, 10 gauge, custom punching, hole pattern as shown on drawings.

2.4 STEEL AND IRON FINISHES

- A. Hot-dip galvanize steel fabrications at exterior locations.
- B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- C. **Organic Powder Finish: Single coat Standard Polyester powder finish complying with AAMA 2603 and containing Standard Polyester resin. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.**
 - 1. Color and Gloss: As selected by Architect

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide anchorage devices and fasteners where needed to secure items to in-place construction.
- B. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.
- C. Fit exposed connections accurately together to form hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers.
- D. Install perforated sheet metal panel with hole pattern centered, balanced, and aligned. Sheet shall be perfectly flat with superior degree of flatness
- E. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel pipe railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. 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.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
 - 2. Fittings and brackets.

3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Rails & posts are indicated to be steel tubing with specific outside diameter. Several tube thicknesses, or use of additional reinforcing bar inside tube, may be employed in order to meet required structural performance for handrails and guards, which shall be as shown on shop drawings, accompanied by supporting structural calculation & be submitted to University's Representative for review & approval.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- F. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 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 in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 1. Provide galvanized finish for exterior installations and where indicated.

- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Finishes
 - 1. Surface Preparation: Remove loose scale, rust, grease, oil, moisture

2.4 FASTENERS

- A. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with **Section 099000 "Painting and Coating"**.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Intermediate Coats and Topcoats: Provide products that comply with Section 099123 "Interior Painting."
- E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sakrete Non-Shrink Grout
 - b. SikaGrout 212
 - c. Quikrete Non-Shrink Precision Grout

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Railing system Joint Construction: Type 2. (Refer to ANSI/NAAMM Pipe Railing System Manual.)
 - 2. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 3. Obtain fusion without undercut or overlap.
 - 4. Remove flux immediately.
 - 5. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
 - 6. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- I. Form Changes in Direction as Follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with fully welded flat end cap. .

2.7 FINISHES

- A. Surface Preparation: Remove loose scale, rust, grease, oil, moisture or other foreign materials to properly prepare the surface for subsequent coating application.

1. Remove loose mill scale, rust and dirt following SSPC-SP2 for hand cleaning and SSPC-SP3 for power tool cleaning.
- B. Galvanizing: Products fabricated from shapes, plates, bars and strips shall be galvanized in accordance with ASTM A 123
- C. Paint: Minimum one coat of rust-inhibitive primer standard with the manufacturer.
- D. Touch-up for Galvanized Surfaces: Use paint primer-meeting FS-TT-P-64:1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 1. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Existing Concrete:

1. Core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement mixed and placed to comply with anchoring material manufacturer's written instructions.
2. Anchoring material flush with adjacent surface.
3. Provide metal escutcheon at base of posts with primed finish.

B. New Concrete:

1. As shown on drawings.

3.5 ADJUSTING AND CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup 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 1 requirements for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and research/evaluation reports.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products identical to those tested for fire resistance per ASTM E 119 or UL 263 by a testing agency acceptable to authorities having jurisdiction.
- B. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Products: One of the following:
 - 1. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5GP
 - 2. Grace, W. R. & Co. - Conn.; Grace Construction Products; Monokote MK-6 Series
 - 3. Isolatek International; Cafco 300.
- B. Material Composition: As follows:
 - 1. Cementitious fireproofing consisting of factory-mixed, dry formulation of gypsum or portland cement binders, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site.
- C. Physical Properties: Minimum values unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, as follows:
 - 1. Dry Density: 15 lb/cu. ft. (240 kg/cu. m), or greater if required to attain fire-resistance ratings indicated, per ASTM E 605.
 - 2. Bond Strength: 150 lbf/sq. ft. (7.2 kPa) per ASTM E 736.
 - 3. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 - 4. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 - 5. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours per ASTM E 859.

- D. **Auxiliary Materials:** Provide auxiliary materials that are compatible with applied fireproofing and substrates and are approved by a testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Clean substrates of substances that could impair bond of fireproofing, including dirt, oil, grease, release agents, rolling compounds, loose mill scale, and incompatible primers, paints, and encapsulants.
- B. Extend fireproofing in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by fireproofing manufacturer, install body of fireproofing in a single course. Spray apply fireproofing to maximum extent possible.
- C. Apply fireproofing in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but not less than **0.375-inch (9-mm)** thickness, and **15-lb/cu. ft. (240-kg/cu. m)** dry density.
- D. Apply sealer/topcoat to fireproofing.
- E. **Testing Agency:** Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 078100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and color Samples.
- B. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

- A. Low-Emitting Materials: Sealants shall comply with the following limits for VOC content:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Nonmembrane Roof Sealants: 300 g/L.
 - 3. Single-Ply Roof Membrane Sealants: 450 g/L.
 - 4. Other Sealants: 420 g/L.
 - 5. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 6. Sealant Primers for Porous Substrates: 775 g/L.
 - 7. Modified Bituminous Sealant Primers: 500 g/L.
 - 8. Other Sealant Primers: 750 g/L.
- B. Low-Emitting Materials:
 - 1. Exterior reactive sealants shall have a VOC content of not more than 50 g/L or 4 percent by weight, whichever is greater.
 - 2. Other exterior caulks and sealants shall have a VOC content of not more than 30 g/L or 2 percent by weight, whichever is greater.
 - 3. Interior sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.
- D. Sealant for Use in Interior Joints in Ceramic Tile and Other Hard Surfaces in Kitchens and Toilet Rooms and Around Plumbing Fixtures:
 - 1. Single-component, mildew-resistant silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT; formulated with fungicide.

E. Sealant for Interior Use at Perimeters of Door and Window Frames:

1. Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

F. Acoustical Sealant:

1. Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission as demonstrated by testing according to ASTM E 90.

2.2 MISCELLANEOUS MATERIALS

- A. Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.
- D. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with ASTM C 1193.
- B. Install sealant backings to support sealants during application and to produce cross-sectional shapes and depths of installed sealants that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal perimeters, control joints, openings, and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions. Comply with ASTM C 919.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Shop Drawings.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

- A. Manufacturers: One of the following:
1. Amweld Building Products, LLC.
 2. Ceco Door Products; an Assa Abloy Group company.
 3. Deansteel Manufacturing Company, Inc.
 4. Steelcraft; Allegion plc.
- B. Fire-Rated Doors and Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. At vertical exit enclosures and exit passageways, provide doors that that have a temperature rise rating of 450 deg F (250 deg C).
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- D. Doors: Complying with SDI A250.8 for level and model and SDI A250.4 for physical-endurance level indicated, 1-3/4 inches (44 mm) thick unless otherwise indicated.
1. Interior Doors: Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
 2. Exterior Doors: Level 2 and Physical Performance Level B (Heavy Duty) Model 1 (Full Flush, metallic-coated steel sheet faces.
 - a. Thermal-Rated (Insulated) Doors: Provide all hollow metal doors with thermal-resistance value (R-value) of not less than 2.9 when tested according to ASTM C 1363.
 3. Hardware Reinforcement: Fabricate according to SDI A250.6 with reinforcement plates from same material as door face sheets.

- E. Frames: ANSI A250.8; conceal fastenings unless otherwise indicated.
 - 1. Steel Sheet for Interior Frames: **0.053-inch- (1.3-mm-)** minimum thickness.
 - 2. Steel Sheet for Exterior Frames: **0.067-inch- (1.7-mm-)** minimum thickness, metallic coated.
 - 3. Interior Frame Construction: Full profile welded.
 - 4. Exterior Frame Construction: Full profile welded.
 - 5. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
 - 6. Frame Anchors: Not less than **0.042 inch (1.0 mm)** thick.
- F. Glazing Stops: Nonremovable stops on outside of exterior doors and on secure side of interior doors; screw-applied, removable, glazing stops on inside, fabricated from same material as door face sheet in which they are installed.
- G. Door Louvers: Sight proof per SDI 111C.
 - 1. Fire-Rated Automatic Louvers: Actuated by fusible links and listed and labeled.
- H. Door Silencers: Three on strike jambs of single-door frames and two on heads of double-door frames.
- I. Grout Guards: Provide where mortar might obstruct hardware operation.
- J. Prepare doors and frames to receive mortised and concealed hardware according to SDI A250.6 and BHMA A156.115.
- K. Reinforce doors and frames to receive surface-applied hardware.
- L. Prime Finish: Manufacturer's standard, factory-applied coat of lead- and chromate-free primer complying with SDI A250.10 acceptance criteria.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, free of scale, pitting, or surface defects.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, **G60 (Z180 or)A60 (ZF180)**.
- D. Frame Anchors: ASTM A 879/A 879M, **4Z (12G)** coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, sheet steel complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install hollow metal frames to comply with SDI A250.11.
 - 1. Fire-Rated Frames: Install according to NFPA 80.
- B. Install doors to provide clearances between doors and frames as indicated in SDI A250.11.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying rust-inhibitive primer. Use galvanizing repair paint for metallic coated surfaces.

END OF SECTION 081113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and color Samples.

PART 2 - PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONTS

- A. Manufacturers: One of the following:
- B. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:
1. Arcadia, Inc.
 2. Kawneer North America; an Alcoa company.
 3. United States Aluminum.
- C. Performance Requirements:
1. Limit deflection of framing members normal to wall plane to 1/175 of clear span or an amount that restricts edge deflection of individual glazing lites to **3/4 inch (19 mm)**, whichever is less.
 2. Limit deflection of framing members parallel to glazing plane to L/360 of clear span or **1/8 inch (3.2 mm)**, whichever is smaller.
 3. Structural Testing: Systems tested according to ASTM E 330 at 150 percent of inward and outward wind-load design pressures do not evidence material failures, structural distress, deflection failures, or permanent deformation of main framing members exceeding 0.2 percent of clear span.
 4. Air Infiltration: Limited to 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of system surface area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
 5. Windborne-Debris Resistance: Framing system and doors pass basic-protection testing requirements in ASTM E 1996 for Wind Zone 1 when tested according to ASTM E 1886.
- D. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated; **ASTM B 209 (ASTM B 209M)** sheet; **ASTM B 221 (ASTM B 221M)** extrusions.
- E. Glazing: As specified in Section 088000 "Glazing."

- F. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- G. Fasteners and Accessories: Compatible with adjacent materials, corrosion resistant, nonstaining, and nonbleeding. Use concealed fasteners except for application of door hardware.
- H. Aluminum Finish: Class II, clear anodic finish; complying with AAMA 611

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Isolate metal surfaces in contact with incompatible materials, including wood, by painting contact surfaces with bituminous coating or primer, or by applying sealant or tape recommended by manufacturer.
- B. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install framing components true in alignment with established lines and grades to the following tolerances:
 - 1. Variation from Plane: Limit to **1/8 inch in 12 feet (3 mm in 3.7 m)**; **1/4 inch (6 mm)** over total length.
 - 2. Alignment: For surfaces abutting in line, limit offset to **1/16 inch (1.5 mm)**. For surfaces meeting at corners, limit offset to **1/32 inch (0.8 mm)**.
 - 3. Diagonal Measurements: Limit difference between diagonal measurements to **1/8 inch (3 mm)**.
- E. Install doors without warp or rack. Adjust doors and hardware to provide tight fit at contact points and smooth operation.

END OF SECTION 084113

SECTION 08422923 - SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of automatic entrances:
 - 1. Exterior, bi-parting, sliding automatic entrances.
 - 2. Size to fit opening between existing posts.

1.2 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- B. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide automatic entrance door assemblies capable of withstanding structural loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).
- C. Opening-Force Requirements for Egress Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.
- D. Closing-Force Requirements: Not more than 30 lbf (133 N) required to prevent door from closing.

1.4 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
- B. Color Samples for selection of factory-applied color finishes.
- C. Closeout Submittals:
 - 1. Owner's Manual.
 - 2. Warranties.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** Manufacturer's authorized representative who is trained for installation and maintenance of units required for this Project.
- B. **Manufacturer Qualifications:** A qualified manufacturer with a manufacturing facility certified under ISO 9001 and with company certificate issued by AAADM.
- C. **Certifications:** Automatic sliding door systems shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
 - 1. ANSI/BHMA A156.10.
 - 2. NFPA 101.
 - 3. Underwriter's Laboratories 325 (UL) listed.
 - 4. IBC
 - 5. BOCA
- D. **Source Limitations:** Obtain automatic entrance door assemblies through one source from a single manufacturer.
- E. **Product Options:** Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated.
- 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. **Emergency-Exit Door Requirements:** Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.6 PROJECT CONDITIONS

- A. **Field Measurements:** General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. **Mounting Surfaces:** General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.
- C. **Other trades:** General Contractor shall advise of any inadequate conditions or equipment.

1.7 COORDINATION

- A. **Templates:** Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.
- B. **Electrical System Roughing-in:** Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies, and remote activation devices.

1.8 WARRANTY

- A. Automatic Entrances shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.
- B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 AUTOMATIC ENTRANCES

- A. Manufacturer: One of the following:
 - 1. Stanley Access Technologies; **Dura-Glide™ 2000 Series**
 - a. Contact: Stanley Access Technologies, 4230 Airport Drive, Suite 107, Ontario CA 91761; Attn: Mike Swinnerton; Phone: 909-664-0157, Fax: 877-598-0702, Email: Michael.Swinnerton@sbdinc.com.
 - 2. Horton Automatics Inc.; Series 2001
 - 3. Dorma Automatics, Inc.; ESA 200 Series

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Headers, stiles, rails, and frames: 6063-T6.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Sheet and Plate: ASTM B 209.
- B. Sealants and Joint Fillers: Manufacturer's standard, performed within this Section of Specifications.

2.3 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelights, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.
- B. Sliding Automatic Entrances:

1. Configuration: Two sliding leaves and two partial panels; bi-parting.
2. Traffic Pattern: Two-way.
3. Emergency Breakaway Capability: Sliding leaves only.
4. Mounting: Surface applied.
5. Custom Opening Width: Fit between existing steel posts and aluminum vertical mullion enveloping steel posts that form clear openings. Verify dimensions in filed.

2.4 COMPONENTS

- A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
1. Nominal Size: 1 3/4 inch by 4 1/2 inch (45 by 115 mm).
 2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket, and continuous flush insert cover, extending full length of each framing member.
- B. Stile and Rail Doors and Sidelights: Manufacturer's standard 1 3/4 inch (45 mm) thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails or mechanically fasten corners with reinforcing brackets that are welded.
1. Glazing Stops and Gaskets: Snap-on, extruded-security aluminum stops and preformed gaskets.
 2. Stile Design: Medium stile; 3 1/2 inch (95 mm) nominal width.
 3. Bottom Rail Design: Minimum 10 inch (254 mm) nominal height.
 4. Muntin Bars: Horizontal tubular rail member for each door; 4 1/4 inch (108 mm) nominal height.
- C. Glazing: Provide glazing for sliding automatic entrances as follows:
1. Provide safety glass complying with ANSI Z97.1 and CPSC 16 CFR 1201 for Category II materials.
 2. Glass: 1 inch (25 mm) insulated glazing units, with fully tempered panes in all panels. Insulated glass panes shall incorporate a 1/2 inch (13 mm) dehydrated air space.
 - a. Inboard lites shall be 1/4 inch (6 mm) clear.
 - b. Outboard lites shall be 1/4 inch (6 mm) equal to or better than PPG Solarban® 60 Low-E on surface #2; clear.
 - c. Units shall be hermetically sealed with a dual seal.
- D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: Concealed, with one side of header flush with framing.

2. Capacity: Capable of supporting up to 220 lb (100 kg) per panel, up to four panels, over spans up to 14 feet (4.3 m) without intermediate supports.
 3. Continuous single piece for both sliding doors, or with fine hair line joint with concealed clips at center between the two sliding doors, visually appear as single continuous piece.
- E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch (3 mm); consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by 2 inch (51 mm) diameter anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing roller wheels and two anti-rise rollers for each active leaf. Minimum load wheel diameter shall be 2 1/2 inch (64 mm).
- F. Thresholds: Manufacturer's standard thresholds as indicated below:
1. Continuous standard tapered extrusion single bevel. Full length of door assembly in fully opened position.
 2. All thresholds to conform to details and requirements for code compliance
- G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
- H. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.5 DOOR OPERATORS

- A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.
- B. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.
1. Operation: Power opening and power closing.
 2. Features:
 - a. Adjustable opening and closing speeds.
 - b. Adjustable back-check and latching.
 - c. Adjustable braking.
 - d. Adjustable hold-open time between 0 and 30 seconds.
 - e. Obstruction recycle.
 - f. On/Off switch to control electric power to operator.
 - g. Energy conservation switch that reduces door-opening width.
 - h. Closed loop speed control with active braking and acceleration.
 - i. Variable obstruction recycle time delay.
 - j. Self adjusting stop position.
 - k. Self adjusting closing compression force.

1. Optional Switch to open/Switch to close operation.
 3. Mounting: Concealed.
 4. Drive System: Synchronous belt type.
- C. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

2.6 ELECTRICAL CONTROLS

- A. Electrical Control System: Electrical control system shall include a microprocessor controller and a high-resolution position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed.
1. The high-resolution encoder shall have a resolution of not less than 1024 counts per revolution. Systems utilizing external magnets and magnetic switches are not acceptable.
 2. Electrical control system shall include a 24 VDC auxiliary output rated at 1 amp.
- B. Performance Data: The microprocessor shall collect, and store performance data as follows:
1. Counter: A non-resettable counter to track operating cycles.
 2. Event Reporting: Unit shall include non-volatile event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
 3. LED Display: Display presenting the current operating state of the controller
- C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
1. Automatic Reset Upon Power Up.
 2. Main Fuse Protection.
 3. Electronic Surge Protection.
 4. Internal Power Supply Protection.
 5. Resettable sensor supply fuse protection
 6. Motor Protection, over-current protection
- D. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.
- E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.

- F. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be software driven and shall be utilized via Palm® handheld interface. The following parameters may be adjusted via the configuration tool.
1. Operating speeds and forces as required to meet ANSI/BHMA A156.10.
 2. Adjustable and variable features as specified in 2.05, B., 2.
 3. Reduced opening position.
 4. Fail Safe/Secure control.
 5. Firmware update.
 6. Trouble Shooting
 - a. I/O Status.
 - b. Electrical component monitoring including parameter summary.
 7. Software for local configuration tool shall be available as a free download from the sliding automatic entrance manufacturer's internet site.
 8. Manual programming shall be available through local interface which has a two-digit display with a selection control including three push buttons.

2.7 ACTIVATION AND SAFETY DEVICES

- A. Combined Activation and Safety Sensors: Combined activation and safety sensors shall, in a single housing, detect motion and presence in accordance with ANSI/BHMA A156.10. Motion shall be detected using K-band microwave technology, presence by active infrared reflection technology.
1. Mounting Height: Up to 11.5 feet (3.5 m) above finish floor
 2. Temperature Range: Between -31°F and 131°F (-35°C to 55°C) in all environmental conditions
 3. Relays: Form C, 50V at 0.3A for both activation and safety. Hold time of less than 0.5 seconds.
 4. Detection Pattern: When detection is made in the activation zone, and the entrance opens, the safety zone shall extend through the threshold on each side; creating an X-pattern. When activation and safety zones are cleared and the entrance closes the sensor will ignore the X-pattern safety zones.
 5. Combined motion and presence sensors shall be equal to or better than X-Zone Sensor by Optex.
- B. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting. Beams shall be monitored by electrical controls for faults and shall fail safe.
- C. Presence Sensor Monitoring: Sliding automatic entrances control system shall include a means to verify the functionality of all active presence sensors in accordance with ANSI/BHMA A156.10. A detected fault shall cause automatic operation to cease until the fault is corrected.

2.8 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.
- B. Emergency Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.
 - 1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
 - 2. Limit Arms: Limit arms shall be provided to control swing of sliding panels on break-out; swing shall not exceed 90 degrees. Limit arms shall be spring loaded to prevent shock, and include adjustable friction damping.
- C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1 inch (25 mm) long throw bolt; ANSI/BHMA A156.5, Grade 1.
 - 1. Cylinders: As specified in Division 8 Section "Door Hardware."
 - 2. Hook Latch: Laminated-steel hook, mortise type.
 - 3. Lock/Unlock Indicator: Provide lock position indicators integrated with locking system. Indicators shall be stile mounted on the secure side of the door and provide a visual display of lock position; "OPEN" in black letters when unlocked, "LOCKED" in red letters when locked.
 - 4. Two-Point Locking: Provide locking system that incorporates a device in the stile of active door leaves that automatically extends a flush bolt into overhead carrier assembly.
- D. Control Switch: Provide manufacturer's standard header mounted rocker switches and door position switch to allow for full control of the automatic entrance door. Controls to include, but are not limited to:
 - 1. One-way traffic
 - 2. Reduced Opening
 - 3. Open/Closed/Automatic
- E. Power Switch: Sliding automatic entrances shall be equipped with a two position On/Off rocker switch to control power to the door.
- F. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; vinyl.
- G. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

2.9 FABRICATION

- A. General: Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
 - 1. Form aluminum shapes before finishing.
 - 2. Use concealed fasteners to greatest extent possible.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
- B. Framing: Provide automatic entrances as prefabricated assemblies.
 - 1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are sharp, straight, and free of defects or deformations.
 - 4. Prepare components to receive concealed fasteners and anchor and connection devices.
 - 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.
- F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

2.10 ALUMINUM FINISHES

- A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.
- B. Class I, Color Anodic Finish: AA-M12C22A42/A44 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.70 mils minimum complying with AAMA 611-98, and the following:
 - 1. Color: Champagne
 - 2. AAMA 606.1

3. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.
- D. Glazing: Glaze sliding automatic entrance door panels in accordance with, the Glass Association of North America (GANA) Glazing Manual, published recommendations of glass product manufacturer, and sliding automatic entrance manufacturer's instructions.
- E. Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants" to provide weather tight installation.

3.3 FIELD QUALITY CONTROL

- A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation, for weather-tight closure, and complying with requirements in ANSI/BHMA A156.10.

3.5 CLEANING AND PROTECTION

- A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with requirements in Division 8 Section “Glazing”, for cleaning and maintaining glass.

END OF SECTION 08422923

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Hardware schedule.
2. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cut-outs and reinforcing.
 - a. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

B. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

1.2 QUALITY ASSURANCE

A. Comply with the followings.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - b. Hardware Schedule shall be prepared and signed by an AHC.
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.

5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20-minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflicts exist.
6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

- B. Review Project for extent of finish hardware required completing the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.3 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.4 WARRANTY:

- A. Manufacturer's Warranty:
 1. Closers: Ten years
 2. Exit Devices: Three Years
 3. Locksets & Cylinders: Three years
 4. All other Hardware: Two years.

PART 2 - PRODUCTS

2.1 HARDWARE

- A. Fire-Resistance-Rated Assemblies: Provide products that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for applications indicated. On exit devices provide label indicating "Fire Exit Hardware."
- B. Hinges:

1. Manufacturers: One of the following:
 - a. IVES, Allegion plc.
 - b. Hager Companies.
 - c. Stanley Commercial Hardware; Div. of The Stanley Works.
 2. Stainless-steel hinges with stainless-steel pins for exterior.
 3. Nonremovable hinge pins for exterior and public interior exposure.
 4. Ball-bearing hinges for doors with closers and entry doors.
 5. Three hinges for **1-3/4-inch- (45-mm-)** thick doors **90 inches (2300 mm)** or less in height; four hinges for doors more than **90 inches (2300 mm)** in height.
- C. Locksets and Latchsets:
1. Manufacturers:
 - a. Schlage Commercial Lock Division; Allegion plc. L9070, Design 06.
 2. BHMA A156.3, Grade 1 for exit devices.
 3. BHMA A156.13, Series 1000, Grade 2 for mortise locks and latches.
 4. Lever handles on locksets and latchsets.
 5. Provide trim on exit devices matching locksets.
- D. Cylinders:
1. Manufacturers:
 - a. Schlage Commercial Lock Division; Allegion plc. Schlage cylinders with Primus high security full size interchangeable core
 - b. Key locks to the University's existing master-key system.
 2. Provide cylinders for **SLIDING AUTOMATIC ENTRANCES** and other locking doors that do not require other hardware.
 3. Provide construction keying.
- E. Exit Devices:
1. Von Duprin, Allegion plc, Inpact 9447L-F.
 2. Double door application with two concealed vertical rods.
 3. Provide standard trim with lever.
- F. Closers:
1. Manufacturers: One of the following:
 - a. Arrow USA; an ASSA ABLOY Group company.
 - b. DORMA Architectural Hardware; Member of The DORMA Group North America.

- c. LCN Closers; Allegion plc.
 - 2. Mount closers on interior side (room side) of door opening, **unless noted otherwise**. Provide regular-arm, parallel-arm, or top-jamb-mounted closers as necessary.
 - 3. Adjustable delayed opening (accessible to people with disabilities) feature on closers.
- G. Door Bottom:
- 1. Manufacturers: One of the following:
 - a. Pemko; an ASSA ABLOY Group company.
 - b. Reese Enterprise, Inc.
 - c. Zero International
- H. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- I. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.
- J. Stops: Provide wall stops or floor stops for doors without closers.
- 2.2 HARDWARE FINISHES:
- 1. Hinges: Matching finish of lockset/latchset.
 - 2. Locksets, Latchsets, and Exit Devices: Satin chrome plated;
 - 3. Closers: Matching finish of lockset/latchset.
 - 4. Other Hardware: Matching finish of lockset/latchset.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount hardware in locations required to comply with governing regulations and according to SDI A250.8 and DHI WDHS.3.
- B. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet.
- C. Deliver keys to the University's Representative.

3.2 HARDWARE SCHEDULE

- A. Hardware Set No. 1

1. Cylinder.

B. Hardware Set No. 2:

1. Hinges.
2. Mortise classroom lock (F05).
3. Cylinder
4. Closer. (interior side)
5. Door Stop.
6. Door bottom.
7. Door silencer.
8. Threshold and weather stripping.

C. Hardware Set No. 3:

1. Hinges (existing pivot).
2. Two exit devices, concealed vertical rod.
3. Two closers. (Corridor or exterior side)
4. Two Door Stop.
5. Two bottom
6. Door silencer
7. Threshold and weather stripping

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.
 - 1. GANA Publications: "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- C. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.
- E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

PART 2 - PRODUCTS

2.1 GLASS, GENERAL

- A. Fire-Resistance-Rated Assemblies: Provide products that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for applications indicated.
- B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201. Provide safety glazing labeling where safety glass is indicated.
- C. Windborne-Debris Resistance: Glazing passes basic-protection testing requirements in ASTM E 1996 for Wind Zone 1 when tested according to ASTM E 1886.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3.
- C. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials.
- D. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

2.3 MONOLITHIC-GLASS TYPES

- A. Glass Type GL-1: Clear fully tempered float glass.
 - 1. Thickness: 6.0 mm
 - 2. Provide safety glass.

2.4 LAMINATED-GLASS TYPES

- A. Glass Type GL-2: Clear laminated glass with two plies of clear fully tempered float glass.
 - 1. Thickness of Each Glass Ply: 6.0 mm
 - 2. Provide safety glass.

2.5 INSULATING-GLASS TYPES

- A. Glass Type GL-3: Low-e-coated, clear insulating glass.
 - 1. Overall Unit Thickness: **1 inch (25 mm)**.
 - 2. Thickness of Each Glass Lite: 6.0 mm.
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Fully tempered float glass.
 - 6. Provide safety glass.

2.6 GLAZING SEALANTS

- A. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. **Products:** One of the following:

- a. Dow Corning Corporation; 799.
 - b. GE Advanced Materials - Silicones; UltraGlaze SSG4000
 - c. Tremco Incorporated; Proglaze SSG
- B. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.
- C. Low-Emitting Materials: Sealants shall have a VOC content of not more than 250 g/L.
- D. Low-Emitting Materials: Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are contained in GANA's "Glazing Manual."
- B. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- C. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 088000

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Obtain tile of each type and color or finish from same production run for each contiguous area
- C. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling ceramic tile packages.

PART 2 - PRODUCTS

2.1 CERAMIC TILE

- A. Ceramic tile that complies with Standard grade requirements in ANSI A137.1, "Specifications for Ceramic Tile."
- B. Tile Type CT-1: Factory-mounted glass mosaic tile.
 - 1. Manufacturers:
 - 2. Basis-of-Design Product: Datile Glass Mosaic, Waves GH01, or a comparable product of one of the following:
 - a. American Olean; Division of Dal-Tile International Inc.
 - b. Daltile; Division of Dal-Tile International Inc.
 - c. Portobello America, Inc.
 - 3. Module Size: **3/4 by 3/4 inch (19 by 19 mm)**

2.2 INSTALLATION MATERIALS

- A. Low-Emitting Materials: Adhesives and fluid-applied waterproofing membranes shall have a VOC content of 65 g/L or less.
- B. Low-Emitting Materials: Adhesives and fluid-applied waterproofing membranes shall comply with Green Seal's GS-36 and with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Setting and Grouting Materials: Comply with material standards in ANSI's "Specifications for the Installation of Ceramic Tile" that apply to materials and methods indicated.
1. Thin-Set Mortar Type: Glass Tile Premium.
 - a. Manufacturers: One of the following:
 - 1) [Bostik, Inc.](#)
 - 2) [Custom Building Products.](#)
 - 3) [Laticrete International, Inc.](#)
 2. Grout Type: Polymer modified.
 - a. Manufacturers: One of the following:
 - 1) [Bostik, Inc.](#)
 - 2) [Custom Building Products.](#)
 - 3) [Laticrete International, Inc.](#)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- C. Lay tile in grid pattern unless otherwise indicated. Align joints where adjoining tiles on floor, base, walls, and trim are the same size.
- D. Interior Wall Tile Installation Method(s):
 1. Over Concrete and Masonry: TCA W202 (thin-set mortar)

END OF SECTION 093000

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data
2. Samples
 - a. Samples: Minimum 6 inch x 6 inch samples of each specified acoustical panel; 8 inch long samples of exposed wall molding and each color of suspension system, including main runner and 4 foot cross tees.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Standard: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 ACOUSTICAL PANELS AP-1

- A. Basis-of-Design Product: Armstrong World Industries, Inc., ULTIMA Tegular: 1911.
- B. Classification: As follows, per ASTM E 1264:
 1. Type and Form: Type: IV, Form: 2.
 2. Pattern: E.
 3. Surface-Burning Characteristics: Class A
- C. Color: White.
- D. Thickness: 3/4 inch
- E. Modular Size: 24 by 24 inches (610 by 610 mm).

2.3 CEILING SUSPENSION SYSTEM

- A. Ceiling Suspension System: Direct hung; ASTM C 635, heavy-duty structural classification.
 - 1. Basis-of-Design Product: Armstrong World Industries, Inc. Prelude XL, 15/16" exposed tee.
- B. Attachment Devices: Sized for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 1. Size: Provide yield strength at least 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung), but not less than **0.135-inch- (3.5-mm-)** diameter wire.
- D. Seismic Struts: Manufacturer's standard product designed to accommodate seismic forces.
- E. Seismic Clips: Manufacturer's standard seismic clips designed to secure panels in place.
- F. Hold-Down Clips: Manufacturer's standard product; provide at **24-inch (610-mm) spacing on cross tees.**)
- G. Access: Identify upward and downward access tile with manufacturer's standard unobtrusive markers for each access unit.

2.4 MISCELLANEOUS MATERIALS

- A. Acoustical Tile Adhesive: Type recommended by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.
 - 1. Adhesive shall have a VOC content of 50 g/L or less.
 - 2. Adhesive shall comply with Green Seal's GS-36 and with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
- C. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

- A. Install acoustical ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
- C. Install acoustical tiles in coordination with suspension system with edges resting on flanges of main runner and cross tees, and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - 1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.
- D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect.
- E. Arrange directionally patterned acoustical units as indicated on Drawings.

3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

1. Latex paint to match tiles and suspended acoustical ceilings should be used to hide minor scratches and nicks in the surface and to cover field tegularized edges that are exposed to view.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095100

SECTION 096500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: Submit manufacturer's product data and installation instructions for each product.
2. Samples:
 - a. 8 x 10 inches samples of high performance resilient sheet vinyl flooring
 - b. Minimum 4-inch length of Welding Threads
 - c. Minimum 2-inch length of Metal Edge strips
 - d. Samples showing the required colors for wall base, corners, and applicable accessories.
3. Shop Drawings: Submit dimensioned drawings with placement details. Include the following information:
 - a. Seam layout

B. Extra Materials:

1. Resilient Sheet Flooring: Deliver to Owner at least 10 **linear feet**, in roll form and in full roll width, for each type and color of resilient sheet flooring installed.

1.2 CLOSEOUT SUBMITTALS

A. Closeout Submittals: Submit following:

1. Warranty: Warranty documents specified
2. Maintenance Data: Maintenance data for installed products include:
 - a. Methods of initial maintenance to be performed 48 hours after installation
 - b. Methods for maintaining installed products

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installation procedures should be in strict accordance with manufacturer's published technical documentation and shall not begin until the work of all other trades has been completed.

- B. Provide types of wall base and accessories supplied by one manufacturer, unless noted otherwise, including leveling strips, moldings and adhesives.
- C. Pre-installation Meetings: Conduct preinstallation meeting to verify project requirements, manufacturer's installation instructions, maintenance guidelines and manufacturer's warranty requirements.

1.4 DELIVERY, STORAGE & HANDLING

- A. Ordering:
 - 1. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery, Storage and Protection:
 - 1. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
 - 2. Store materials in clean, dry and temperature-controlled environment.
 - 3. Remove rolls from shipping pallet immediately and store standing on end.
 - 4. Wrap opened rolls tightly and face out to avoid material distortion. Store standing on end.
 - 5. Maintain storage temperature range of 65 - 85 degrees F (18 - 29 degrees C).
 - 6. Ensure materials and adhesives are correct for job, and that pattern, color, style and lot numbers match those called for in finish schedule as specified for project.
- C. Install wall base and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the wall base.
- D. Waste Management and Disposal:
 - 1. Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.5 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's 10-year product warranty document executed by authorized company official.
- B. The resilient sheet vinyl shall be covered against manufacturing defects by a one (1) year warranty and as a result of normal foot traffic; wear is covered by a ten (10) year warranty. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

PART 2 - PRODUCTS

2.1 RESILIENT BASE WB-1

- A. Basis-of-Design Product: Burke Mercer Flooring Products; Division of Burke Industries, Inc.
- B. Color and Pattern: As selected by Architect
- C. ASTM F 1861, Type TS (rubber, vulcanized thermoset).
- D. Group (Manufacturing Method): I (solid)
- E. Style: Cove (base with toe).
- F. Minimum Thickness: **0.125 inch (3.2 mm)**.
- G. Height: **4 inches (102 mm)**.
- H. Lengths: Coils in manufacturer's standard lengths.
- I. Outside Corners: Preformed, pre-mitered outside corners..
- J. Inside Corners: Job formed, mitered at corners using a standard compound or sliding compound miter saw.
- K. Finish: As selected.

2.2 RESILIENT MOLDING ACCESSORY TR-1

- A. Basis-of-Design Product: Johnsonite.
- B. Color: As selected by Architect.
- C. Profile and Dimensions: As selected by Architect.

2.3 VINYL COMPOSITION FLOOR TILE VCT-1:

- A. Basis-of-Design Product: Mohawk Group, Antiek C0015.
- B. Color and Pattern: 131 Bisque.
- C. Classification: ASTM F 1700, Class III, Type B - Embossed
- D. Fire-Test Response: Critical radiant flux classification of Class I, not less than 0.45 W/sq. cm per ASTM E 648.

- E. Smoke Density: ASTM E662 - Passes
- F. Thickness: 0.1 inch (2.5 mm).
- G. Size: 48 in x 9 in (1219 x 228 mm).
- H. Seaming Method: Standard (butted).

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement- or blended hydraulic cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.
 - 1. Basis-of-Design Product: Forbo Sustain 885m
- C. Low-Emitting Materials: Adhesives shall comply with Green Seal's GS-36 and with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Primer Purpose: Made and designed to encapsulate substrate provided or recommended by underlayment manufacturer and approved by manufacturer.
- E. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
 - 1. Low-Emitting Materials: Chemical-bonding compound shall have a VOC content of 510 g/L or less.
 - 2. Low-Emitting Materials: Chemical-bonding compound shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Metal Edge Strips: Extruded aluminum with mill finish of narrowest width as standard with manufacturer, of height required to protect exposed edges of sheet vinyl, and in maximum available lengths to minimize running joints.
- G. Integral-Flash-Cove-Base Accessories: ~~1-inch-~~ (25.4-mm-) radius cove strip and square metal cap; both provided or approved by floor covering manufacturer.
 - 1. Provide metal inside and outside corners and end stops.
- H. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and manufacturer's product specifications.
- B. Prepare concrete substrates according to ASTM F 710. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
- C. Smooth wall surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, drywall joints, and other defects as recommended by the manufacturer.
- D. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations. Avoid organic solvents.
- E. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.
- F. Maintain uniformity of resilient sheet flooring direction, and match edges for color shading at seams.
- G. **Layout the length of the flooring piece parallel to the length of the room.**
- I. Wall Base:
 - 1. Adhesively install resilient wall base and accessories.
 - 2. Install wall base in maximum lengths possible without gaps at seams and with tops of adjacent pieces aligned. Apply to walls, columns, pilasters, casework, cabinets in toe spaces and other permanent fixtures in rooms or areas where base is required.
 - 3. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 4. Do not scratch wall base during installation.
 - 5. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
 - 6. Pre-mitered Corners: Install pre-mitered corners before installing straight pieces.
 - 7. Job-formed Corners:
 - a. Inside Corners: Install pre-mitered corners first. Seat the bottom of the wall base snugly to the floor on either side of the corner. Anaerobic adhesive (Super Glue) may be used to adhere the two mitered pieces together prior to adhering to the wall. This can eliminate any slight gapping. Butt straight pieces of maximum lengths on either side of the pre-mitered corners. Make sure heights of the corner returns and the straight base match up.
- J. Install reducer strips at edges of floor coverings that would otherwise be exposed.

K. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor covering before applying liquid floor polish.

1. Apply a minimum of two coat(s).

3.2 FIELD QUALITY CONTROL

1. Inspect completed assembly for proper level and alignment.
2. Repair or replace damaged products prior to Substantial Completion.

3.3 CLEANING AND PROTECTION

- A. After installation, remove excessive adhesive pursuant to manufacturer's published instructions.
- B. Clean resilient materials pursuant to manufacturer's published instructions.
- C. On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- D. Protect installed resilient flooring product from damage during construction by providing adequate protective covering such as Masonite or Homasote panels in order to protect vinyl from damage caused by ladders and construction traffic.
- E. Install and maintain entry matting with a non-staining backing to reduce tracked-in dirt and contaminants.

3.4 MAINTENANCE

- A. Consult manufacturers, suppliers and janitorial services as to the suitability of a specific product for maintenance.
- B. Wait several days, at least 48 hours, after installation before cleaning a new installation to allow time for the wall base to bond firmly. During this period the wall base should be protected against traffic.
- C. Initial maintenance is essential for increased longevity of vinyl flooring. Ensure initial maintenance is completed 48 hours after installation. Depending on resilient floor covering style, this may include;

END OF SECTION 096500

SECTION 099000 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Product Data
 - 2. Samples.
- B. Mockups: Full-coat finish Sample of each type of coating, color, and substrate, applied where directed.
- C. Extra Materials: Deliver to Owner **1 gal. (3.8 L)** of each color and type of finish coat paint used on Project, in containers, properly labeled and sealed.

PART 2 - PRODUCTS

2.1 PAINT

- A. Manufacturers: One of the following:
 - 1. Benjamin Moore & Co.
 - 2. Dunn-Edwards Corporation.
 - 3. Frazee Paint.
- B. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its "MPI Approved Products List."
 - 1. Exterior Painting Materials:
 - a. Block Filler, Latex: MPI #4.
 - b. Primer, Galvanized, Water Based: MPI #134.
 - c. Primer, Latex: MPI #6.
 - 2. Interior Painting Materials:
 - a. Primer, Alkyd, Anticorrosive: MPI #79.
 - b. Alkyd, Interior, Gloss (Gloss Level 6): MPI #48.
- C. Material Compatibility: Provide materials that are compatible with one another and with substrates.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
 - D. Use interior paints and coatings that comply with the following limits for VOC content:
 1. Nonflat Paints, Coatings: 150 g/L.
 2. Primers, Sealers, and Undercoaters: 200 g/L.
 3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250g/L.
 - E. Colors: As selected.
- 2.2 INTERIOR HIGH PERFORMANCE COATING APPLICATION - CONCRETE FLOOR PAINT
- A. Manufacturers: One of the following:
 1. Rust-Oleum Corporation; S60 Water-Based Epoxy Maintenance Coating.
 2. Sherwin-Williams Company; Armorseal 8100.
 3. No known equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.
- C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

3.2 APPLICATION

- A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Paint exposed surfaces, new and existing, unless otherwise indicated.
 1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
 2. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint the back side of access panels.
 4. Color-code mechanical piping in accessible ceiling spaces.

5. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.
- C. Apply paints according to manufacturer's written instructions.
1. Use brushes only for exterior painting and where the use of other applicators is not practical.
 2. Use rollers for finish coat on interior walls and ceilings.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- E. Apply stains and transparent finishes to produce surface films without color irregularity, cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other imperfections. Use multiple coats to produce a smooth surface film of even luster.

3.3 EXTERIOR PAINT APPLICATION SCHEDULE

- A. Steel:
1. Semigloss, Alkyd: Two coats over alkyd anticorrosive primer: MPI EXT 5.1D.
- B. Galvanized Metal:
1. Semigloss Latex: Two coats over waterborne galvanized-metal primer: MPI EXT 5.3H.
- C. Stucco:
1. Flat Latex: Two coats: MPI EXT 9.1A.

3.4 INTERIOR PAINT APPLICATION SCHEDULE

- A. Gypsum Board or Plaster:
1. Gloss Level 2 Latex: Two coats over latex primer/sealer: MPI INT 9.2A.
- B. Steel:
1. Semigloss, Quick-Dry Enamel: Two coats over quick-drying alkyd metal primer: MPI INT 5.1A.
 2. Semigloss Latex: Two coats over alkyd anticorrosive primer: MPI INT 5.1Q.

C. Galvanized Metal:

1. Semigloss Latex: Two coats over waterborne galvanized-metal primer: MPI INT 5.3J.

3.5 INTERIOR HIGH PERFORMANCE COATING APPLICATION SCHEDULE

A. Concrete, Traffic Surfaces:

1. Water-based Epoxy: Two coats: MPI INT 3.2C.

END OF SECTION 099000

SECTION 260000 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

- A. Work of this section includes everything necessary for or incidental to completing the electrical work, to provide a complete and operable electrical system, except as herein specifically excluded.

1.2 GENERAL REQUIREMENTS

- A. Electrical System Characteristics: 120/208V. 3PH, 4W.
- B. Guarantee: Furnish a written guarantee for a period of one-year from date of acceptance.
- C. Codes and Regulations: Work done under this Section shall comply with the latest edition of the following: California Electrical Code, State of California Title 24, State Building Standards, Occupational Safety and Health Administration (OSHA) requirements, State of California Title 17 and to all local codes having jurisdiction. In the case where the codes have different levels of requirements, the most stringent rule shall apply.
- D. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to insure complete and operable systems as required by the Owner and Engineer.
- E. The General and Supplementary Conditions, as well as Special Conditions apply in addition to items in the Electrical Section. Special attention is directed to the following sections:
 - 1. Drawings and Specifications at the site.
 - 2. Shop drawings and samples.
 - 3. Record drawings.
 - 4. Cutting and Patching.
 - 5. Cleaning up.
 - 6. Guarantee.
 - 7. Tests.
- F. Additional Work: Refer to furniture vendor drawings and specifications for additional Electrical requirements.
- G. Testing:

1. Scan:
 - a. Infracan test of the distribution branch circuit panels affected by the remodel shall be required.
 - b. Infracan certified reports shall be submitted on completion to the Owner and Engineer.
 - c. Scans shall be performed by an independent testing laboratory with total connected loads in operation.
 2. Megger:
 - a. New or re-used branch circuits - phase, neutral and ground conductors.
 - b. New or re-used insulated bonding conductors.
 3. All circuits shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
 4. Grounding System: Shall be tested by an independent testing laboratory to meet resistance specified in Part 3.1, D.3 of these Specifications. It shall be this Contractor's responsibility to make adjustments, as required, to upgrade non-complying systems to proper and safe operation.
 5. All certified testing reports shall be submitted to the Owner at completion of project.
- H. All Core Cutting, Drilling, and Patching:
1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Architectural/Structural sections of the Specifications.
 2. No holes will be allowed in any structural members without the written approval of the Structural Engineer.
 3. For penetrations of concrete slabs or concrete footings, the work will be as directed in the Concrete Section of Specifications.
 4. The contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
 5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.
- I. Verifying Drawings and Job Conditions:
1. This Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
 2. This Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.
- J. Shop Drawings/Product Submittals:

1. Drawings shall be submitted in six (6) bound sets accompanied by Letter of Transmittal, which shall give a list of the number and dates of the drawings submitted. Drawings shall be complete in every respect and bound in sets.
 2. The Drawings submitted shall be marked with the name of the project, numbered consecutively and bear the approval of the Contractor as evidence that the Drawings have been checked by the Contractor. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
 3. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in his letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment which may be caused by the substitution. Complete working samples shall be submitted with all requests for substitution.
 4. Shop drawings/product data shall be submitted on the following but not limited to:
 - a. Lighting fixtures and drivers.
 - b. Circuit breakers and mounting hardware.
 - c. Switches/Occupant sensors/Disconnect switches.
 - d. Receptacles.
 - e. Fuses.
 - f. Pull boxes.
 - g. Conduit and fittings.
 - h. Wire/conductors.
 - i. Conduit supports.
 5. Shop drawings shall include scaled site plans and floor plans indicating the location of all equipment, devices, interconnecting wire/cable, wiring diagrams and sequence of operation.
 6. Shop drawings shall include copies of the contractor's current C-10 license.
- K. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of blueprints. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.3 WORK IN COOPERATION WITH OTHER TRADES

- A. Examine the Drawings and Specifications and determine the work to be performed by the site utilities contractor, mechanical and plumbing contractor and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation of all systems or equipment whether shown on plan or not.

- B. Provide power and control circuits, conduit and wire as indicated on the furniture vendor drawings, as required for complete and operable systems.
- C. The electrical contractor shall be responsible for providing and installing specialty back-boxes for all systems. The electrical contractor shall patch, repair and refinish walls, ceilings or floors disturbed by the installation of the subject back boxes.

1.4 TESTING AND ADJUSTMENT

- A. Upon completion of all electrical work, this Contractor shall test all circuits, switches, motors, breakers, motor starter(s) and their auxiliary circuits and any other electrical items to insure perfect operation of all electrical equipment.
- B. Equipment and parts in need of correction and discovered during such testing shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.
- C. All circuit shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All certified testing reports shall be submitted to the Engineer at completion of project.

1.5 IDENTIFICATION

- A. Provide typed, updated, panel directories for all panels affected by the remodel. The description for each circuit shall match the load(s) served and as identified on the Drawings.
- B. Identification of Outlet Wall Plates: Outlet wall plates shall be engraved with the serving panel and circuit number on the front of the plate.

1.6 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating and maintenance and servicing instructions, as well as four (4) complete wiring diagrams for the following item(s) or equipment:
 - 1. Circuit breakers.
 - 2. Switches.
 - 3. LED drivers.
 - 4. Occupant sensors, power packs, relay packs.
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Two (2) copies shall be presented to the Electrical Engineer and four (4) copies to the Owner.

1.7 ELECTRICAL CONTRACTOR'S RESPONSIBILITY

- A. It shall be the Electrical Contractor's responsibility to obtain a complete set of Drawings and Specifications. He shall check the Drawings of the other trades and shall carefully read the entire Specifications and determine his responsibilities.
- B. Contractor shall carry a valid State of California contractor's license.

1.8 FINAL INSPECTION AND ACCEPTANCE

- A. After all requirements of the Specifications and/or the Drawings have been fully completed, representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.9 RECORD DRAWINGS

- A. Contractor shall furnish one set of reproducible record drawings before final payment of retention.

1.10 SUBSTITUTIONS

- A. Substitution to specified equipment shall be submitted and received by the Engineer fifteen (15) days after the bid date for review and approval.
- B. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letter form and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples must be included in the submittal.
- C. In the event that authorization is given for a substitute equal to bid, after award of contract the Contractor shall submit to the Engineer certified quotations from suppliers of both the specified and proposed equal material for price comparison and delivery dates.
- D. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
- E. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- F. Substitutions or requests for substitution shall not be accepted and rejected for failure to comply with items A-E above.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials and Equipment: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety. In addition, the materials and equipment shall comply with the requirements of the following:
1. American Society of Testing Materials (ASTM).
 2. Insulated Cable Engineers Association (ICEA).
 3. National Electrical Manufacturer's Association (NEMA).
 4. National Fire Protection Association (NFPA).
 5. American National Standard Institute (ANSI).
- B. Branch Circuit Panelboards – Circuit Breakers:
1. Provide thermal-magnetic bolt-on type 40 deg C. circuit breakers complete with required mounting hardware and accessories. Circuit breakers manufacturer shall match existing panelboard. Equipment manufactured by third party OEM is not acceptable.
 2. Circuit breaker short circuit rating shall be equal to or greater than the highest AIC rated circuit breaker in the panel.
 3. Circuit breakers shall be the number of poles and current capacity as indicated on the panel schedule with terminals/lugs UL listed for 75°C. Circuit breakers shall be fully coordinated to ensure a local fault does not trip any upstream circuit breaker.
 4. Circuit breakers shall be provided with a device for locking circuit breaker in "OFF" position.
 5. All wiring in the panel shall be neatly arranged and laced together.
- C. Lighting Fixtures:
1. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure, chips and drivers.
 2. LED Driver shall be Class 1, 120-277V, 50/60HZ (constant current) with surge protection in accordance with IEEE/ANSI C62.41.2 guidelines with a surge current rating of 10,000 amps. Operating temperature for interior fixtures shall range from 0°C to 35°C (32°F to 95°F). Operating temperature for exterior fixtures shall range from -40°C to 40°C (-40°F to 104°F). All defective drivers shall be replaced at no cost to the Owner.
 3. LED chips shall be as manufactured by CREE, Philips-Lumileds, Nichia, Osram or approved equal.
 4. Interior fixtures installed in individual rooms shall be provided with LED chips of the same manufacturer. Mixing of chip manufacturers will not be allowed. All fixtures in any one room must be replaced with new fixtures when the fixtures in the room display dissimilar illumination colors.

5. Exterior fixtures shall be provided with LED chips of the same manufacturer. Mixing of chip manufacturers will not be allowed. All fixtures within line of sight must be replaced with new fixtures when the fixtures in the line of sight display dissimilar illumination colors.
6. LED chips shall have 4000° Kelvin color temperature. Interior fixtures shall meet IESNA LM-79-08. Exterior fixtures shall meet IESNA LM-80-08.
7. Where indicated on the Lighting Fixture Schedule, interior light fixtures shall be provided with integral occupancy sensor and/or daylight sensor.
8. Provide two (2) programming/configuration tools for programming automatic control devices.
9. Refer to Architectural reflected ceiling plan for type of ceiling being installed in each room and provide each fixture with required mounting devices and accessories for the particular ceiling.
10. All light fixtures shall be individually supported and properly anchored to the surfaces indicated on the Architectural elevations.
11. Locations of fixtures shall be per the architectural reflected ceiling plan and shall be coordinated at time of rough-in.

D. Conduit:

1. Rigid conduit shall be full weight threaded type aluminum or steel, except where specifically required to be steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metallizing or sherardizing process.
2. Galvanized Rigid Conduit (GRC), shall be full weight threaded type aluminum or steel, except where specifically required to be steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metallizing, or sherardizing process.
3. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242 and meeting Federal Specification WWC-581 (latest revision).
4. Electrical Metallic Tubing (EMT), shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces.
5. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Used only as directed by the Engineer.
6. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory installed fittings. For outdoor installations and motor connection.
7. Non-Metallic Conduit:
8. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only.
9. Conduit and fitting shall be produced by the same manufacturer.
10. Electrical non-metallic tubing (ENT) is not permitted.

E. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or

- removal of wires and cables from the conduit and tubing system. These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
- 2. Metallic conduit covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductor do not pass through the cover.
- 3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
- 4. EMT fittings, connectors and couplings, shall be steel, zinc or cadmium plated, raintight, threadless, compression or tap-on multiple point, steel locking ring type with insulated throat.
- 5. Flexible steel conduit connectors shall be malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
- 6. Die cast, set screw or indenter type fittings are not acceptable.
- 7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

F. 600 Volt Conductors - Wire and Cable:

- 1. All conductors shall be stranded copper. Simpull type or equal.
- 2. Type THHN/THWN thermoplastic, 600 volt, UL approved, dry and wet locations, for conductor sizes up to and including #4 AWG.
- 3. Type XHHW cross-linked synthetic polymer, 600 volt, UL approved, for dry and wet locations, for conductor sizes #2 AWG. and above.
- 4. Cross-linked synthetic polymer, XHHW, 600 volts, UL approved, for installation underground, in concrete or masonry.
- 5. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
- 6. Wire and cable shall be factory color coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color coded and it shall be maintained throughout.
- 7. Systems Conductor Color Coding:
 - a. Power 208/120V, 3PH, 4W:
 - 1) Phase A = Black
 - 2) Phase B = Red
 - 3) Phase C = Blue
 - 4) Neutral = White
 - 5) Switchlegs = Purple (Switchlegs shall also be identified separately by numerical tags).
 - 6) Travelers = Purple with Black stripe.
 - b. Ground Conductors:
 - 1) Green
- 8. Multi-Conductor metal clad (MC) cable is not permitted.

9. All color coding for #4 conductor and above shall be as identified above, utilizing phase tape at each termination.
10. No conductors carrying 120 volt or more shall be smaller than #12 AWG.

G. Outlet Boxes:

1. For fixtures, boxes shall be galvanized, steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.
2. Unless otherwise noted on plan or specified herein, outlet boxes shall be 4" square x 2 1/8" deep, steel, knockout type, mounted flush with in wall. Provide with plaster rings and wall plate.
3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements and submitted for approval.
4. For surface mounting or exposure to wet or damp locations, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.
5. Floor boxes shall be cast iron, fully adjustable type, with flange and brass covers suitable for the outlets/connectors specified on plan and in the project manual. Boxes shall be suitable for terminating the conduit specified on plan. Wiremold Omnibox series or approved equal for 1" conduit and smaller. Wiremold Resource RFB series or approved equal for conduits larger than 1".

H. Switches/Dimmers/Sensors:

1. Standard single pole switches shall be flush tumbler, A.C. rated, quiet type, heavy duty back or side wired with binding screws, standard rocker Hubbell #1221, 20A, 120/277V, or approved equal, color as elected by Architect. Two pole three-way and other switches shall be similar. Refer to Device Plate Section of Specifications for other requirements. Switches that are part of an automatic lighting control system shall be provided with integral, factory installed, connectors to accept the system control wiring, shall be manufactured by the automatic lighting control system manufacturer, and shall be fully compatible with the lighting control system.
2. Dimmers shall be provided with multi-function tap switch with small, raised rocker for dimmer adjustment. Dimmer shall perform the following functions: Rocker shall raise/lower light levels with the new level becoming the current preset level. Switch single tap raises lights to preset level or fades lights to off. Switch double tap raises light to full on level. Switch tap and hold slowly fades lights to off over an extended period. LEDs adjacent to tap switch indicate light level when dimmer is on, and function as locator light when dimmer is off. The contractor shall ensure the dimmers are fully compatible with the LED drivers being controlled. Dimmers that are part of an automatic lighting control system shall be provided with integral, factory installed, connectors to accept the system control wiring, shall be manufactured by the automatic lighting control system manufacturer, and shall be fully compatible with the lighting control system.
3. Switches located outdoors or in damp or wet locations shall be the same as above provided with steel locking weatherproof lift cover.

4. Switches controlling or disconnecting single phase motor loads in excess of 1/3HP shall be horsepower rated and approved or motor control service. Switches shall be complete with overload device of proper motor nameplate rating, where required.
 5. Disconnect (safety) switches shall be fused, heavy duty type meeting NEMA Specifications. Switches shall be provided with rejection type fuse blocks. Provide switches with the number of poles, the voltage, current and horsepower ratings as required. Provide externally operable, quickmake, quick-break type mechanism with cover interlock and padlockable in either the open or closed position. Unless indicated otherwise, provide switches indoors in NEMA Type 1 enclosure and in NEMA Type 3R rain-tight enclosure where indicated to be outdoors or weatherproof. Provide nameplate indicating equipment served. Provide unit as manufactured by Challenger or approved equal Siemens or Westinghouse.
 6. Occupant sensors shall be low voltage, dual technology type, suitable for ceiling or wall mounting. Stand-alone ceiling mounted sensors shall be provided complete with relay/power pack and slave-packs to perform the switching indicated on plan. Sensors that are part of an automatic lighting control system shall be provided with integral, factory installed, connectors to accept the system control wiring. Sensors shall provide minimum 1,000 square foot coverage and provide complete coverage of the areas indicated on plan. Stand-alone sensors shall be as manufactured by Sensor Switch, Watt Stopper or Leviton. System sensors shall be as manufactured by the automatic lighting control system manufacturer and shall be fully compatible with the lighting control system.
 7. Occupant sensors located in hallways/corridors shall be programmed to automatically dim the lights to 50% when the space is unoccupied. Hallway/corridor sensors shall be capable of detecting motion within a 130'-0" area. Stand-alone sensors shall be provided complete with relay/power pack and slave-packs.
 8. Wall mounted, switch type, combination sensor and dimmer shall be dual technology type with single or dual circuit to provide the control indicated on plan. Sensors shall provide minimum 900 square feet major motion and 400 square feet minor motion coverage. Sensor shall have a multi-function tap switch with small, raised rocker, for dimmer adjustment. Sensors shall be as manufactured by Sensor Switch or approved equal Lutron, WattStopper or Leviton. Custom color as selected by the Architect. The contractor shall ensure the dimmers are fully compatible with the LED drivers being controlled.
 9. All switches, dimmers and sensors shall be listed and certified by the California Energy Commission.
- I. Receptacles:
1. Convenience outlet shall consist of duplex convenience receptacle mounted in an outlet box in the wall, flush with the finish surface and shall be complete with plate.
 2. Receptacles for convenience outlets, unless otherwise indicated, shall be industrial heavy duty type, duplex 3W grounding type, 20A, 125V, Hubbell-Bryant #5362-*. (*) color as selected by Architect.
 3. Weatherproof receptacle shall be industrial heavy duty type, ground fault interrupter, 20 ampere, three wire grounding type, 120 volt, Hubbell-Bryant # GF-5362-I, with steel lockable lift cover U.L. listed for "wet" locations when in operation.

4. Receptacles located outdoors shall be provided with steel weatherproof box and lockable lift cover U.L. listed for “wet” locations when in operation.
5. Receptacles in indoor damp locations shall be 20A, 125V, Hubbell-Bryant #5362WR or approved equal, color as selected by Architect. Provide with steel locking lift cover, Hubbell-Bryant #96067 or approved equal.
6. Specialty receptacles, identified on plans, for use with Owner furnished equipment shall be provided complete with outlet box, wall plate and receptacle to match the configuration of the plug being provided with the subject equipment.

J. Device Plates:

1. Shall be smooth thermoplastic wall plates, for the number of gang and types of openings necessary. Color shall be as selected by the Architect.
2. Plates shall be fitted, when specified for more than two gangs.
3. All switch and receptacle plates shall be engraved with related serving panel and circuit number identification on the front.
4. Plates for interior high abuse areas shall be stainless steel.
5. Covers for exterior mounted receptacles shall be metallic, U.L. listed for wet locations when “in-use”.

K. Junction and Pullboxes:

1. For interior dry locations, boxes shall be galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.
2. For outside, damp or interior/exterior surface mounted locations, boxes shall be heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.
3. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required. Each conductor shall be terminated at an insulated, barriered terminal connector and completely identified with an engraved fiber identification marker, Electrovert or Underwriter's Safety Device Company.

L. Painting:

1. Panels, junction boxes, pull boxes, conduit bodies, etc., and conduit installed outdoors and in public view shall be painted with colors selected by the Architect to match the subject exterior surface. Refer to painting section of the specifications for additional requirements.

M. Seismic Design and Anchoring of Electrical Equipment:

1. Seismic anchorage of electrical equipment shall conform to C.C.R. Title 24, 2019 CBC. Anchorage details for roof/floor mounted equipment shall be as shown on plans.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

A. Installation of Conduit and Outlet Boxes:

1. All conduit exposed or installed in concrete and masonry, shall be galvanized rigid steel conduit (GRC), or intermediate metal conduit (IMC).
2. Rigid conduit may be installed under floor slabs, under concrete sidewalls and as noted on the Drawings. Rigid conduit installed under slabs shall be 1" trade size minimum and shall be wrapped with 20 mil. polyvinyl chloride plastic tape.
3. All conduit except as hereinafter specified, installed in concrete or masonry walls, or damp or hazardous location, or subject to mechanical injury shall be heavy wall, threaded, galvanized rigid steel conduit (GRC), or intermediate metal conduit (IMC).
4. Flexible steel conduit shall only be permitted to be used for routing of conductors within the furniture raceway, and for the final connection to light fixture outlets. All flexible steel conduit runs for connection to light fixtures shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Use of flexible conduit shall be as approved by the Engineer.
5. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or EMT and in accordance with Article 345 of CEC and UL Information card #DYBY.
6. All conduit installed in the dry walls or ceilings of the building shall be steel tube (EMT), Galvanized Rigid Steel (GRC), or Intermediate Metal Conduit (IMC).
7. MC cable is not allowed.
8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
11. Underground conduit shall be, unless otherwise indicated, Schedule 40 PVC (polyvinyl chloride) installed at depth of not less than 24" below grade. Where power and communication/signal conduits are run in a common trench a (12") inch minimum separation shall be maintained between power and communication/signal conduits. The grounding wire in plastic conduit shall be rated in accordance with Article 250 of 2019 CEC.
12. All underground or imbedded conduit shall be 1" minimum trade size for steel and for PVC.
13. Where underground power feeder conduit runs stub-up, conduit shall transition to GRC underground. The contractor shall use GRC elbows and GRC risers wrapped in 20 mil. PVC tape for stub-ups. Conduit stub-ups for branch circuits and low voltage systems shall be PVC.
14. PVC conduit shall not be run in walls.
15. Where underground conduit runs penetrate floor slab, conduit shall terminate 6" above finished floor with a grounding bushing.

16. Where conductors enter a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
17. All conduit underground and where concealed under floor slabs shall have joints painted with thread compound prior to makeup. No conduit shall be installed horizontally in concrete walls or floors.
18. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two hole conduit clamp properly secured.
19. Where conduit racks are used the rack shall consist of two piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.
20. Nail-in conduit supports will not be allowed. One piece set-screw type conduit clamps or perforated iron for supporting conduit will not be permitted.
21. Seismic Conduit Support:
 - a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

<u>CONDUIT TYPE</u>	<u>MAXIMUM SPACING</u>
EMT, IMC	10'-0"
GRC (3/4" thru 1 1/2")	10'-0"
GRC (2" thru 2 1/2")	16'-0"
GRC (3" and larger)	20'-0"

22. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
23. Open knockouts in outlet boxes only where required for inserting conduit.
24. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or bolted to studs; on wood studs attachment shall be with wood screws, nails not acceptable.
25. All boxes shall be covered with outlet box protector, Appleton SB-CK. Keep dirt from entering box or panels. If dirt does get in, it shall be removed prior to pulling wires.
26. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover and painted as directed by the Architect with weatherproof paint to match building.
27. All conduit entries to outdoor mounted cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
28. All conduit shall have a 200 lb test poly-propylene pull line left in place for future use in all runs tagged with a plastic tag at terminating end indicating the location of the opposite end of the conduit.
29. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches.
30. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/rack, see note 19. Refer to note 18 for support of single conduit runs within suspended ceilings. Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system.

31. Provide complete conduit system for all line voltage systems. The Contractor shall coordinate the location of junction/pull boxes over inaccessible ceilings with the Architectural Reflected Ceiling Plan and in the filed with the ceiling contractor, and provide access panels as required to access the junction/pull box.
32. All raceways shall be installed concealed in walls, floors or ceilings. Exposed raceways will not be permitted unless specifically approved in writing by the Architect/Engineer. When approved by the Architect/Engineer exposed raceways shall be as manufactured by Wiremold, or approved equal, and shall be painted to match the finish of the wall or ceiling to which it is supported to.
33. Provide minimum 18" square ceiling access panels for devices, outlets, junction/pull boxes installed over inaccessible ceilings.

B. Installation of Conductors:

1. All line voltage wire, including control circuits, shall be installed in conduit.
2. All line voltage circuits and feeder wires shall be continuous from the service point to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
3. All low voltage wire/cables shall be continuous from the service point to terminal or farthest outlet. No joints will be allowed.
4. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires. No line voltage joint shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
5. Install UL approved, fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.

C. Joints in 600 Volt Conductors:

1. Joints in 600 volt conductors smaller than No. 4 AWG shall be made with Scotchlok spring type connectors. Wires No 4 AWG and larger shall be joined together with approved type of pressure connector and taped with #33 3M tape, three (3) layers minimum to provide insulation not less than that of conductor. Connections to switch or busbar shall be made with one-piece copper lugs. Splicing of all 600 volt or less in-line connections #2 AWG through 350 MCM shall be made with 3M brand PST connector.
2. Joints/splices will not be permitted in underground pull boxes unless specifically authorized by the Engineer.

D. Grounding:

1. Provide grounding for entire electric installation as shown on plans and as required by applicable codes. Included as requiring grounding are:
 - a. Conduit.
 - b. Neutral or identified conductors of interior wiring system.
 - c. Switchboards and Branch Circuit Panelboards.
 - d. Non-current carrying metal parts of fixed equipment.
 - e. Telephone distribution equipment.

2. Grounding and bonding conductors shall be sized per the latest edition of the California Code of Regulations, Title 24, State of California and the CEC.
 3. Provide and install an equipment grounding conductor in all feeder and branch circuit conduits.
 4. Grounding system resistance to ground shall not exceed 25 ohm.
- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.

END OF SECTION

SECTION 28311 - DIGITAL ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Manual Fire Alarm Boxes.
 - 2. Analog Sensors.
 - 3. Notification Appliances.

1.2 DEFINITIONS

- A. Definitions in NFPA 72 and UL 864 are inclusive to this section.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. FACP: Main Fire Alarm Control Panel.
- E. MINIPLEX: Remote input/output panel connected to a FACP via Remote Unit Interface.
- F. NETWORK: FACP(s) interlinked via dedicated fiber connections to the GCC.
- G. GCC: Graphical Command Center – Campus FACP Network Portal.
- H. IMS: Integrated Management System – Campus FACP Network Portal.
- I. DACT: Digital Alarm Communication Transmitter – FACP Alarm Reporting media to the Campus Police Department.
- J. TAC: Notification power supply and controller for addressable horns and strobes.
- K. TPS: An addressable Notification Power supply mounted in an FACP enclosure.
- L. RPS: Remote Power Supply for conventional horns and strobes.

1.3 SYSTEM DESCRIPTION

- A. Non-coded, UL 864 9th edition, UL-certified analog-addressable system with automatic sensitivity control of system smoke detectors at the main panel and the GCC.
- B. Multiplexed signal transmission, dedicated to fire service only.

1.4 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. UL listed and labeled.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Seismic Performance FACP and raceways shall withstand the effects of earthquake motions determined according to the VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEM SPECIFICATION SECTION.

1.5 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals: Product Data and system operating description.
 - 2. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals, make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations.
 - 3. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Fire alarm certified by NICET, minimum Level II.
- B. Product Data:
 - 1. Provide manufactures data sheets and CSFM listing sheets for all products.
- C. Shop Drawings:
 - 1. Fire Alarm System:
 - a. Include plans, elevations, sections, details, riser diagrams general notes, location, Scope of the Work and attachments to other work.
 - b. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 - c. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" chapter in NFPA 72.
 - d. Include voltage drop calculations for all notification appliance circuit.
 - 1) Worst case only calculations are not acceptable.

- e. Include battery-size calculation(s) with stand-by and alarm loads for all components.
 - f. Include electrical panel and circuit number for all 120VAC sources.
 - g. Device Address:
 - 1) Show the address for each addressable device shown on the plans.
 - 2) Coordinate custom device label with DCFM prior to programming labels.
 - h. System Riser Diagram: Show all equipment, terminal cans, devices, conduit routing, cable routing and cable type and quantity. Provide ladder type riser lay-out with all interconnecting conduits.
 - i. Wiring Diagrams: Provide wiring type, part number, manufacture and color code.
 - j. Power, Signal, and Control Wiring: Include diagrams for equipment and for system with all terminals and interconnections identified.
 - k. Duct Smoke Detectors: Provide performance parameters and installation details for each duct detector or in-duct detector, provide the complete range of air velocity, temperature, and humidity allowed for proper operation. Provide weatherproof detail for all roof top mounted and/or exposed detectors.
 - l. Ductwork Drawings: Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors on plans according to manufacturer's written recommendations.
 - m. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show route of cable and conduits.
 - n. Room numbers: Confirm room numbers being used in programming are the final numbers assigned by Facilities Management.
- D. Submittals to Designated Campus Fire Marshal (DCFM): In addition to distribution requirements for submittals specified in Division 01 Section "Submittals", make an identical submittal to the University. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit as required to make clarifications or revisions to obtain approval. On receipt of comments from Campus Fire Marshal, submit them to the University for review.
- E. Resubmittals: Make corrections and resubmit drawings as required until the plans are reviewed and approved by the Campus Fire Marshal.
- F. Delegated-Design Submittals: The Mechanical Engineer of Record will coordinate the specific location of each duct detector with the mechanical, electrical and fire alarm contractors prior to the installation of any duct mounted device.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications:
- 1. Personnel installing wire, cable, devices or making final connections shall be trained or supervised by the manufacturer.
 - 2. Installers shall be licensed, as required, by the State of California.

B. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to California State Fire Marshal and marked for intended use.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by the University or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify the University's Representative no fewer than fourteen days in advance of proposed interruption of fire alarm service.
2. Do not proceed with interruption of fire alarm service without the University's Representative written permission.

1.8 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP)

A. General: Comply with UL 864 9th editions, "Control Units for Fire-Protective Signaling Systems."

B. The following minimum FACP hardware shall be provided:

1. 120 VAC input power powered panel with 250 points capacity expandable to 2000 in groups of 250 points, 9 amps of system power with 3 built in NAC circuits, a battery charger and batteries
 - a. Point capacity is defined where (1) point equals (1) monitor (input) or (1) control (output).
2. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
3. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output.
4. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.

5. One Auxiliary Relay, SPDT 2A @ 32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
 6. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
 7. Power Supplies with three integral intelligent Notification Appliance Circuit Class B for system expansion.
 8. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
 9. The FACP shall support (6) RS-232-C ports and one service port.
 10. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciator and I/O panels.
 11. Programmable DACT for either Common Event Reporting or per Point Reporting.
 12. Service Port Modem for dial in passcode access to all fire control panel information.
- C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
- D. Alphanumeric Display and System Controls: Panel shall include an 80-character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
- E. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone.
 2. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface.
 3. Each amplifier shall provide at least 3 on-board NAC circuits for speaker circuit connection.
 4. All announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.
 5. Eight channel digitally multiplexed audio for systems that require more than two channels of simultaneous audio. Up to 8 channels of audio shall be multiplexed on either a style 4 twisted pair.
 6. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.
- F. Distributed Module Operation:

1. FACP shall be capable of allowing remote location of the following modules:
 - a. Amplifiers, voice and telephone control circuits.
 - b. Addressable Signaling Line Circuits.
 - c. Initiating Device Circuits.
 - d. Notification Appliance Circuits.
 - e. Auxiliary Control Circuits.
 - f. Graphic Annunciator LED/Switch Control Modules.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements and approval of the University's Representative, provide products compatible with the existing Campus GCC and Network:

1. FACP Equipment and enclosures:
 - a. SimplexGrinnell.
 - b. WSA.
 - c. Hoffman (weatherproof applications only).
2. Wire and Cable:
 - a. Comtran Corporation.
 - b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
 - c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
 - d. West Penn Wire/CDT; a division of Cable Design Technologies.
3. Audible and Visual Signals:
 - a. SimplexGrinnell.
 - b. Wheelock (weatherproof applications only).

2.3 SYSTEM OPERATIONAL DESCRIPTION

- A. Fire alarm signal initiation shall be by one or more of the following devices or systems:

1. Manual Station.
2. Analog Sensor.
3. Smoke Detector.
4. Duct Detector.
5. Heat Detector.
6. Flame Detector.
7. Beam Detector.
8. Automatic Sprinkler System Water Flow.
9. Special Extinguishing System.
10. Fire Standpipe System.
11. GCC.

12. Networked FACP.

B. Fire alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at the fire alarm control panel.
3. Transmit alarm signal to the campus police department as required.
4. Transmit alarm signal to the GCC and Network as required.
5. Unlock electric door locks as required.
6. Release fire and smoke doors and magnetic door holders as required.
7. Activate notification devices as required.
8. Activate Sprinkler Bell (waterflow only).
9. Activate general alarm horn (all but waterflow).
10. Close smoke dampers as required.
11. Recall or shunt elevators as required.
12. Record events in the system memory.
13. Record events by the Network printer.
14. Record events on the GCC and/or IMS.
15. Networked FACP action(s) as required.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at FACP, MINIPLEX or TAC.
4. Abnormal ac voltage at FACP, MINIPLEX or TAC.
5. Break in standby battery circuitry.
6. Failure of battery charger.
7. Abnormal position of any switch at FACP, MINIPLEX, TAC or remote annunciator.
8. Abnormal condition of any pre-action or suppression system.
9. Disabled device.
10. Loss of Network communication.

E. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.

F. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled,

and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the network printer.

2.4 ADDRESSABLE MANUAL FIRE ALARM BOXES

- A. UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
- B. Single-action mechanism, pull-lever type. With integral addressable module, arranged to communicate individual manual-station status (normal, alarm, or trouble) to the FACP and Campus GCC.
- C. Weatherproof Fire Alarm Boxes: Provide weatherproof single-action devices with addressable module.
- D. Covers: Factory-fabricated clear plastic enclosures are not permitted to be used.

2.5 ADDRESSABLE ANALOG SENSORS

A. SMOKE SENSORS

- 1. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems."
- 2. Include the following features:
 - a. Factory Nameplate: Serial number and type identification.
 - b. Operating Voltage: 24 VDC, nominal.
- 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
- 4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
- 5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
- 6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
- 7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.

8. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
 9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
 10. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
 11. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type.
1. Where acceptable per manufacturer specifications, ionization type sensors may be used.
- C. Bases: Relay output, Remote LED, sounder and isolator bases shall be supported alternatives to the standard base.
- D. Duct Smoke Sensor:
1. Photoelectric type, with housing and sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
 2. When required the Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
 4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 8. Where indicated a NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.
 9. Provide in-duct detector assembly(ies) with Photoelectric sensor:
 - a. Where sampling tube designs are not appropriate.
 - b. Where air flow coverage is from 35-600 Ft/Min.
 10. Provide a remote test switch (RTS), on all duct type detectors when the device's alarm LED is obstructed from being clearly visible from the floor or the device is mounted higher than 9' A.F.F.

- a. Mount RTS below detector in the ceiling or on the nearest sidewall as directed by the DSFM.

2.6 HEAT SENSORS

A. Thermal Sensor:

1. Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
2. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
3. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
4. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.7 CONVENTIONAL SYSTEM SMOKE DETECTORS

- A. Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP, internet and Campus GCC.
- B. A digital communication port shall comply with EIA RS232 Protocol.
- C. The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically, 24-hours standby battery back-up is required followed by 30 minutes in an alarm condition.
- D. Local Power Supply Standards that may apply: UL 1481 Listed (provided the power supply and standby batteries have been appropriately sized/rated to accommodate the system's power requirements).
- E. The detector shall provide a supervised input circuit with which the remote power supply trouble contact may be monitored. Activation of power supply trouble output contact shall cause detector to transmit power supply trouble status information to the attached control panel. A 47 K ohm E.O.L. resistor shall be used for monitoring circuit purposes.

2.8 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of water flow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.

- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.
- C. There shall be the following types of modules:
1. Type 1: Monitor Circuit Interface Module:
 - a. For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
 - b. For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
 2. Type 2: Line Powered Monitor Circuit Interface Module:
 - a. This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
 - b. This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 3. Type 3: Single Address Multi-Point Interface Modules:
 - a. This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
 - b. This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - c. This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single

address. The two-wire signaling line circuit shall supply power and communications to the module.

4. Type 4: Line Powered Control Circuit Interface Module: This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
 5. Type 5: 4-20 mA Analog Monitor Circuit Interface Module: This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.
- D. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.9 ADDRESSABLE ALARM NOTIFICATION APPLIANCES

A. Addressable Notification Appliances:

1. The Contractor shall furnish and install Addressable Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).
2. Addressable Notification appliance operation shall provide power, supervision and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft. and a minimum 3 twists (turns) per foot.
3. Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 63 appliances can be supported on a single channel.
4. Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.
5. Addressable Controller:
 - a. Addressable Controller shall supervise Channel (SLC) wiring, communicate with and control addressable notification appliances. It shall be possible to program the High/Low setting of the audible (horn) appliances by channel from the addressable controller.

6. Horn:
 - a. Addressable horn shall be listed to UL 464. Horn appliances shall have a High/Low Setting, programmable by channel from the addressable controller or by appliance from the host FACP. The horn shall have a minimum sound pressure level of 83 or 89 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.
 - b. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot.

7. Visible/Only:
 - a. Addressable strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The wall mount V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. The ceiling mount V/O shall mount to a single gang electrical box.
 - b. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

8. Audible/Visible:
 - a. Addressable combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 83 or 89 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.
 - b. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot.
 - c. The appliance shall be capable of two-wire synchronization with one of the following options:
 - 1) Synchronized Strobe with Horn on steady.
 - 2) Synchronized Strobe with Temporal Code Pattern on Horn.
 - 3) Synchronized Strobe with March Time cadence on Horn.
 - 4) Synchronized Strobe firing to NAC sync signal with Horn silenced.

9. Isolator Module:
 - a. Isolator module provides short circuit isolation for addressable notification appliance SLC wiring. Isolator shall be listed to UL 864. The Isolator shall mount directly to a minimum 2 1/8" deep, standard 4" square electrical box, without the use of special adapter or trim rings.

- b. Power and communications shall be supplied by the Addressable Controller channel SLC; dual port design shall accept communications and power from either port and shall automatically isolate one port from the other when a short circuit occurs.
- c. The following functionality shall be included in the Isolator module:
 - 1) Report faults to the host FACP.
 - 2) On-board Yellow LED provides module status.
 - 3) After the wiring fault is repaired, the Isolator modules shall test the lines and automatically restore the connection.

B. TrueAlert Addressable Appliances NAC Power Extender:

- 1. The TrueAlert Addressable Controller shall be a stand-alone panel capable of powering a minimum of 3 TrueAlert Signaling line circuits. Each channel shall be rated for 2.5 amps and support up to 63 TrueAlert addressable notification appliances. Power and communication for the notification appliances shall be provided on the same pair of wires.
- 2. Addressable SLC notification appliance circuits shall be Class B Style 4. Unless noted elsewhere.
- 3. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
- 4. The NAC extender panel may be mounted close to the host control panel or can be remotely located.

2.10 REMOTE INDICATORS

A. Remote status and test switches with LED indicating lights.

- 1. LED is connected to flash when the associated device is being polled by the FACP.
- 2. The LED and LED test switch are mounted on a plate and designed to flush mount to a single-gang electrical.

2.11 MAGNETIC DOOR HOLDERS AND CLOSERS

A. Description:

- 1. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
- 2. Interfaced to the FACP to shut down on alarm.
- 3. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
- 4. Rating:
 - a. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.

B. Material and Finish: Chrome or brushed aluminum unless noted otherwise.

- C. Door holders are to be installed by the door hardware contractor.
- D. Door Closers are to be supplied and installed by the door hardware contractor.

2.12 WIRE, CABLE, AND FIBER

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, sized as recommended by system manufacturer.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 degrees C, color-coded insulation.
 - 1. Low-Voltage Communication Circuits: No. 18 AWG, minimum.
 - 2. Low-Voltage Power Circuits: No. 14 AWG, minimum.
 - 3. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 4. Multi-conductor Armored Cable: NFPA 70 red Lightweight Steel Type MC, copper conductors, TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with the latest edition of NFPA 72 and UL 864 requirements for installation of fire-alarm system.
- B. Equipment Mounting: Install fire alarm cabinets and enclosures as recommended by the manufacturer.
- C. Install seismic bracing: Comply with the requirements in Division 26 section regarding vibration and seismic control for electrical systems.
- D. Smoke or Heat Detector Spacing:
 - 1. Smooth ceiling spacing shall not exceed the rating of the detector.
 - 2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
 - 3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
- E. Smoke detector location: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening. Locate detector not closer than 12 inches from any part of a lighting fixture.

- F. Duct Smoke Detectors: Comply with NFPA 72, NFPA 90A and the manufacture recommendations. Install sampling tubes so they extend the full width of the duct.
- G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm in the dwelling or suite causes all the smoke alarm in the dwelling or suit to sound a temporal pattern.
- H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install horns on flush-mounted back boxes. Weatherproof devices are to be mounted on weatherproof surface back box.
- J. Visible Alarm-Indicating Devices (strobes): Install so that the entire lens is more than 80 inches but less than 96 inches above the finished floor.
 - 1. Exception: Wall mounted strobes in sleeping areas shall be mounted at least 24 inches below the ceiling and within 16ft of the occupant's pillow.
- K. Combination Audible/Visual Devices: Mount at visible device heights.

3.2 FIBER AND WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
 - 3. NFPA, CBC, FCC, RFI/EMI.
- B. Wiring Method:
 - 1. Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes for Electrical Systems."
 - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 - 1. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
 - 2. Signaling Line Circuits: Power-limited fire alarm cables shall be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and

back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors as shown on the fire alarm plans. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. **Provide fire alarm conduits, J-boxes and covers red in color and use compression type fitting.**
- G. Wiring to Remote Alarm Transmitting Device:
 - 1. 3/4-inch conduit between the FACP and the transmitter.
 - 2. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26.
- B. Operating instructions: Frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 FIELD QUALITY CONTROL

- A. Final acceptance testing shall be witnessed by the University's Representative.
- B. A final pre-test shall be witnessed by the University's Representative.
- C. Manufacturer's Field Service:
 - 1. Engage a factory-authorized installation representative to assist during the installation, pre-testing and adjust of the fire alarm system and field devices, components and equipment.
 - 2. Include a manufacturer's field representative during all final acceptance testing.
- D. Perform the following field tests and inspections and prepare test reports:
 - 1. Before requesting final acceptance testing and approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.

2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level II.
3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
4. Testing: Follow procedure and record results complying with requirements in NFPA 72. Detectors that are outside their marked sensitivity range shall be replaced.
5. Test and Inspection Records:
 - a. Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.
 - b. Provide report results in writing on computer generated forms.

3.5 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 Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72.

END OF SECTION 28111