MT DIABLO UNIFIED SCHOOL DISTRICT

Purchasing & Warehouse Department
2326 Bisso Lane, Concord, CA 94520-4802

BID #1945

Modernization of Three Elementary School Campuses, Increment 2

Campus:

MT DIABLO ELEMENTARY

Project #23120.01

SPECIFICATIONS

DSA SUBMITTAL
DSA APPLICATION NO.: 01-121407.
FILE NO.: 07-29

196 ARCHITECTS

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TABLE OF CONTENTS

DIVISION 0 – PROCUREMENT & CONTRACTING REQUIREMENTS
00 00 00 Cover Page
00 00 03 Table of Contents
00 03 00 Stamp Page

DIVISION 1 - GENERAL REQUIREMENTS
01 10 00 Summary
01 26 00 Contract Modification Procedures
01 29 00 Payment Procedures
01 31 00 Project Management and Coordination
01 32 00 Construction Progress Documentation
01 33 00 Submittal Procedures
01 40 00 Quality Requirements
01 42 00 Reference Codes and Standards
01 50 00 Temporary Facilities and Controls
01 58 13 Temporary Project Signage
01 60 00 Product Requirements
01 73 29 Cutting and Patching
01 74 19 Construction Waste Management
01 77 00 Closeout Procedures
01 78 39 Project Record Documents
01 79 00 Demonstration and Training
01 81 19 Construction Indoor Air Quality
01 81 22 Acoustical Performance Requirements
01 81 23 Noise and Vibration Control
01 91 13 General Commissioning Requirements

DIVISION 2 – EXISTING CONDITIONS
02 23 00 Site Clearing
02 41 19 Minor Demolition for Remodel

DIVISION 3 – CONCRETE
03 30 00 Cast in Place Concrete

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES
06 10 00 Rough Carpentry
06 41 00 Interior Architectural Laminated Casework

DIVISION 7 - THERMAL AND MOISTURE PROTECTION
07 21 16 Building Insulation
07 25 00 Weather Barrier

07 92 00 Joint Sealants

DIVISION 8 - OPENINGS
08 17 43 FRP Doors
08 41 00 Aluminum Entrance and Storefront
08 71 00 Door Hardware
08 80 00 Glazing
08 90 00 Louvers and Vents

DIVISION 9 – FINISHES
09 29 00 Gypsum Board
09 30 13 Ceramic Tile
09 51 13 Acoustic Panel Ceiling
09 65 13 Resilient Base and Accessories
09 65 19 Resilient Tile Flooring
09 67 00 Fluid-Applied Flooring
09 68 13 Carpet Tile
09 84 33 Sound Absorbing Wall Units
09 91 00 Painting

DIVISION 10 – SPECIALTIES
10 11 00 Visual Display Surfaces (Marker Boards ONLY)
10 14 00 Signage
10 26 00 Wall Protection
10 28 00 Toilet and Bath Accessories

DIVISION 12 – FURNISHINGS
12 36 61 Quartz Counters and Surfacing

DIVISION 22 – PLUMBING
22 00 00 Plumbing General Requirements
22 02 00 Plumbing

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING
23 00 00 Mechanical General Requirements
23 05 00 Heating Ventilating Air Conditioning
23 05 93 Testing Adjusting Balancing
23 08 00 Commissioning of HVAC Systems
23 09 23 Direct Digital Control System for HVAC

DIVISION 26 – ELECTRICAL
26 05 00 General Requirements for Electrical Systems
26 05 05 Selective Demolition for Electrical

26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 29 Hangers and Supports for Electrical Systems
26 05 33.13 Conduit for Electrical Systems
26 05 33.16 Boxes for Electrical Systems
26 05 33.23 Surface Raceways for Electrical Systems
26 05 48 Vibration and Seismic Controls for Electrical Systems
26 05 53 Identification for Electrical Systems
26 05 73 Power System Studies
26 05 83 Wiring Connections
26 09 43 Digital Lighting Controls
26 24 16 Panelboards
26 27 26 Wiring Devices
26 28 13 Fuses
26 28 16.16 Enclosed Switches
26 51 00 Interior Lighting
26 56 00 Exterior Lighting

DIVISION 27 – COMMUNICATIONS
27 00 00 Communications basic requirements
27 05 00 Common Work Results for Communications
27 10 00 Structured Cabling
27 21 00 Data Communication Network Equipment
27 51 23 Education Intercom Systems
27 51 26 Assistive Listening Systems

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY
28 05 00 General Requirements for Safety and Security
28 05 13 Wire and Cables for Safety and Security
28 20 00 Video Surveillance
28 46 00 Fire Detection and Alarm

DIVISION 31 – EARTHWORK
31 05 13 Soils for Earthwork
31 10 00 Site Clearing
31 22 13 Rough Grading
31 23 00 Excavation and Fill
31 23 16.13 Trenching
31 23 23.13 Backfill

DIVISION 32 – EXTERIOR IMPROVEMENTS
32 11 23 Aggregate Base Course
32 12 16 Asphalt Pavement

32 12 36 Slurry Deal Ex Asphalt Paving
32 13 13 Concrete Paving
32 17 00 Pavement Specialties
32 17 25 Cast in Place Tactile Warning Surface
32 31 13 Chain Link fences and Gates
32 33 00 Site Furnishings

DIVISION 33 - STORM
33 40 00 Storm Drainage Utilities

END OF TABLE OF CONTENTS

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Work covered by the Contract Documents.
   2. Type of the Contract.
   3. Work phases.
   4. Use of premises.
   5. Owner's occupancy requirements.
   6. Work restrictions.
   7. Specification formats and conventions.
   8. Deferred Approvals.
   9. Pollution Control.
   10. Storm Water Pollution Prevention Plan.
   11. Lead-Containing materials.
   12. Additional DSA requirements.

1.3 SUBMITTALS

A. Contractor shall submit written statement of responsibility per CBC 1704A.1

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Mt Diablo Elementary School Campus Modernization

B. Project Location: Mt Diablo Elementary School

C. Owner/ District: Mt Diablo Unified School District

D. Architect:19/six.

E. The Work consists of the following:

1. The Work includes the campus modernization at Mt Diablo Elementary School. The work consists of *GENERAL ALTERATION OF CLASSROOM BUILDINGS 2, 3, 4, 5, 6, 9, and 10*:
   - FLOORING IN-KIND REPLACEMENT
   - FLOORING REPLACEMENT WITH NEW MATERIAL
   - NEW CASEWORK WITH NEW ACCESSIBLE SINKS
   - LIGHTING REPLACEMENT
   - NEW INTERIOR PAINTING
   - REPLACEMENT OF GLUE-UP TILES WITH NEW CEILING TILES
   - REPLACEMENT OF T-BAR CEILING TILES
   - REPLACEMENT OF TACKABLE PANEL
   - REPLACEMENT OF ALL EXTERIOR DOORS WITH NEW FRP DOORS
   - HARDWARE REPLACEMENT AT EXTERIOR DOORS
   - WINDOWS AND CLERESTORY REPLACEMENT WITH NEW
   - REPLACEMENT IN-KIND OF HVAC EQUIPMENT
   - REPAIRS TO EXISTING HVAC EQUIPMENT
   - REPLACEMENT OF DRINKING FOUNTAINS IN KIND
   - UPDATES TO BUILDING 5 STUDENT RESTROOMS
   - PATH OF TRAVEL UPDATES

1.5 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.6 WORK PHASES

A. The Work shall be conducted in ONE PHASE.

1.7 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Owner Occupancy: Allow for Owner occupancy of areas immediately adjacent to the Project site and use by the public.
   2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      - Schedule deliveries to minimize use of driveways and entrances.

- Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.8 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy areas adjacent to the site and existing buildings adjacent to the project during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
   3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
   4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.9 WORK RESTRICTIONS

A. On-Site Work Hours:
   1. Comply with General Conditions.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

1.10 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 49-division format and CSI's Master Format 2004 numbering system.
   1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
   2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
      - The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.11 DEFERRED APPROVALS

A. Deferred Approval Submittals, General:
   1. Submit initial deferred approval submittal to Architect within 35 calendar days from the date of issuance of Notice to Proceed, and before any materials are delivered to the job site. Contractor is solely responsible for obtaining all necessary approvals. Do not commence installation of any deferred approval item until all approvals have been obtained.

2. Product Data: Product data: Submit manufacturer's specifications and certified test reports made by an independent testing organization for each type and class of material to show compliance with code requirements and gain approval of DSA.
3. Shop Drawings: Submit complete shop drawings including dimensioned plans, elevations, and all details of typical sections and connections. Shop drawings shall show design loads and all details of the installation. Title sheet of shop drawings shall list testing requirements and shall state that licensed engineer shall review and certify the completed installation is in accordance with the approved shop drawings. Shop drawings shall be stamped, dated and signed by professional engineer licensed in the State of California as evidence of his or her responsibility for the work.
4. Shop drawings (When hard copies are required):
   - Format: 30" x 42" sheet format with border and title block identifying, at a minimum, the project name, project number, project location, date, contractor and structural engineer of record.
   - 1 set of reproducible shop drawings each submittal review.
   - 1 set of reproducible shop drawings for each plan check review.
   - 1 set of reproducible shop drawings approved by DSA.
5. Contractor shall not copy or make use of the Architect's sealed (stamped/signed) border for any purpose.
6. Calculations: Submit calculations prepared by a professional engineer licensed in the State of California. Engineer shall sign, date and stamp calculations as evidence of his or her responsibility for the work.
7. Submittals shall be approved first by the Architect, then by the DSA.
8. See additional requirements in Division 1 Section "Submittal Procedures".

1.12 POLLUTION CONTROL

A. Provide positive methods, means and facilities required to prevent contamination of the soil, water or atmosphere by the discharge of noxious substances from the construction operations.

1.13 MISCELLANEOUS PROVISIONS

A. Noise and Dust Control: As specified in General Conditions.

1.14 LEAD-CONTAINING MATERIALS.

A. The Contractor shall assume that all ceramic tile and painted or varnished surfaces in the school district contain detectable levels of lead which trigger compliance with

California Code of Regulation, Title 8, Section 1532.1. In addition, waste products from these materials could contain lead at levels which are subject to the hazardous waste requirements in the California Code of Regulations, Title 22, Sections 666260.1 - 66263.12 and 66268.1 - 66268.124 and the health and Safety Code Section 25157.8 and 25163, subdivision (c).

B. It is the Contractor's responsibility to handle and dispose of these materials in accordance with the regulations. If failure to comply with these regulations results in a site or worker contamination, the Contractor will be held solely responsible for all costs involved in any required corrective action.

C. Lead-based paint should be removed only by professionals trained in hazardous material removal. A trained professional must follow very detailed procedures to minimize, control and contain lead dust generated by the removal process.
   1. The room should be sealed from the rest of the building. All furniture, carpets and drapes should be removed.
   2. Workers should wear respirators designed to avoid inhaling lead.
   3. No eating or drinking should be allowed in the work area. All food and eating utensils should be removed from the room. All cabinets as well as food contact surfaces should be covered and sealed.
   4. Occupants should be kept out of the room until the job is completed.
   5. Clothing worn in the room should be disposed of after working. The work clothing should not be worn in other areas of the building.
   6. Debris should be cleaned up using special vacuum cleaners with HEPA (high efficiency particle absorption) filters. A wet mop should be used after vacuuming.

1.15 ADDITIONAL DSA REQUIREMENTS

A. Comply with the following:
   1. Compliance with Title 24, for Parts 1-6 and 9.
   2. Title 24, All applicable parts referred to by the plans and specifications shall be kept on site during construction.
   3. All addenda must be signed by Architect and approved by DSA. (Section 4-338, Part 1)
   4. All substitutions affecting DSA regulated items shall be considered as a Construction Change Document or Addenda, and shall be approved by DSA prior to fabrication and installation. (IR-A6) (Section 4-338(c), Part 1)
   5. Construction Change Document (Section 4-338 (c), Part 1) must be signed by all the following:
      - A/E of Record.
      - Owner (change order only).
      - SEOR (when applicable).
      - Delegated Professional Engineer (when applicable).

- DSA.

6. Project Inspector and testing lab must be employed by the Owner and approved by all of the following:
   - A/E of Record.
   - SEOR (when applicable).
   - DSA.
7. Should any existing conditions such as deterioration or noncomplying construction be discovered that is not covered by the DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

B. Tests and Inspections - Chapter 17A:
   1. All tests shall be performed by a testing facility acceptable to the architect and DSA. The testing facility shall be directly employed by the school district and no other entity or individual. Section Title 24, Part 1, Section 4-335(b).
   2. Test reports shall be addressed to, and sent to, the school district by the testing facility. Copies of all test reports shall be sent to DSA, the architect, the structural engineer, and the project inspector by the testing facility. All reports shall be sent within 14 days of the date of the test. See Title 24, Part 1, Section 4-335(d).
   3. A Verified Report, sigNed by the California licensed civil engineer in charge of the testing facility which conducted the tests, shall be submitted to DSA upon completion of the project. The verified report shall state that all tests and inspections were made as required by the DSA approved documents. If the tests or inspections indicate that materials or workmanship did not meet the requirements of the DSA approved documents, the Verified Report shall list all noncompliant work. A copy of all test reports involving unresolved noncompliant work shall be attached to the Verified Report. In the event that not all required tests or inspections were made by the testing facility making this verified report, those tests and inspections not made shall be listed on the Verified Report. See Title 24, Part 1, Section 4-335(e).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
B. Related Sections include the following:
   1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect may issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, or Changes not affecting the Structural Safety, Access Compliance or Fire & Life Safety portions of the work, on AIA Document G710, "Architect's Supplemental Instructions" or an equivalent form acceptable to District and subject to DSA IR A-6 Construction Change Document Submittal and Approval Process (Title 24, Part 1, California Code or Regulations, Section 4-338) requirements for DSA Construction Change Document – Category B.

1.4 REQUESTS FOR PROPOSAL (RFP)

A. Owner-Initiated Proposal Requests: Architect may issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

1.5 CONSTRUCTION CHANGE PROCESS - DSA

A. Changes or alterations of the approved plans or specifications after a contract for the work has been let affecting the Structural, Access or Fire-Life Safety portions of the project shall be made only by means of Construction Change Documents submitted to and approved by DSA prior to commencement of the work shown thereon. Construction Change Documents shall comply with DSA IR A-6 Construction Change Document Submittal and Approval Process (Title 24, Part 1, California Code or Regulations, Section 4-338) requirements. Construction Change Documents shall be made using DSA form 141 and state the reason for the change and the scope of work to be accomplished, and, where necessary, shall be accompanied by supplementary drawings referenced in the text of the change order. All Construction Change Documents and supplementary drawings shall be stamped and signed by the architect or engineer in general responsible charge of observation of the work of construction of the project and by the architect or registered engineer delegated responsibility for observation of the portion of the work of construction affected by the change order, shall bear the approval of the school board and shall indicate the associated change in the project cost, if any. One copy of each Construction Change Document is required for the files of DSA.
B. Construction Change Documents shall be signed by Architect of Record, Structural Engineer (when applicable), Delegated Professional Engineer (when applicable), and DSA.
C. No changes shall be made to approved documents without DSA approval.
D. If conflicts between the drawings and specifications for the materials to be used and/ or work to be done the more stringent, more restrictive, or higher quality shall apply.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

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SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
B. Related Sections include the following:
   1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.

3. No payment applications will be signed by the Architect prior to the Contractor submitting, and the Architect reviewing, a schedule of values.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Submit draft of AIA Document G703 Continuation Sheets.
   3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.
      g. Dollar value.
         1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
   4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
   5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
   7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
      a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the

Schedule of Values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times:
   1. The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Products list.
   5. Schedule of unit prices.

6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Data needed to acquire Owner's insurance.
15. Initial settlement survey and damage report if required.

G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Project meetings.
   2. Requests for Interpretation (RFIs).
   3. Project Coordination

B. Related Sections include the following:
   1. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
   2. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Contractor shall participate in these coordination requirements. Contractor shall advise during Progress Meetings, the status of overall coordination progress. When necessary, such as in congested spaces where multiple prime contracts are involved, the prime contractors shall meet with the Architect, Owners Representative and other prime contractors involved to resolve critical coordination areas.

D. In the event of coordination disputes or questions, the prime contractors involved shall submit the question or dispute to the Architect. The Architect will provide specific direction relating to the question or dispute. The Owner will not consider requests for additional time or compensation associated with direction provided to prime contractors in response to coordination, questions, or disputes.

E. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

F. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   2. Preparation of Contractor's Construction Schedule.
   3. Preparation of the Schedule of Values.
   4. Installation and removal of temporary facilities and controls.
   5. Delivery and processing of submittals.
   6. Progress meetings.
   7. Pre-installation conferences.
   8. Project closeout activities.
   9. Startup and adjustment of systems.
   10. Project closeout activities.

G. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

11. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
   4. Frequency of Attendance by Architect: Limited by Architect/Owner Contract.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing, if any.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. Preparation of Record Documents.
      l. Use of the premises.
      m. Work restrictions.
      n. Owner's occupancy requirements.

o. Responsibility for temporary facilities and controls.
p. Construction waste management and recycling.
q. Parking availability.
r. Office, work, and storage areas.
s. Equipment deliveries and priorities.
t. First aid.
u. Security.
v. Progress cleaning.
w. Working hours.

3. Minutes: Record and distribute meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
a. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.

y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
1) Review schedule for next period.
b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.

15) RFIs.
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.5 RFIs:

A. General:
1. Contractor may submit a RFI to the Architect seeking clarification or interpretation of the contract documents. If in the Contractor's opinion the nature of the RFI requires a discussion, rather than simply an answer, the Contractor shall call the Architect to have such a discussion. The results of that discussion as well as all other RFI's must be presented in writing on a form approved in advanced by the Architect along with any supporting information or data, as well as the Contractor's recommended resolution. An oral RFI or a RFI presented on an unapproved form, or without adequate supporting information and Contractor's recommended solution, will be attributed solely to the contractor. Architect's review of or responses to RFI's shall not constitute an approval, direction, or procedure related to the construction means, methods, techniques, sequences, or procedures of the Contractor.
2. Architect's review of or responses to RFI's shall not constitute an approval, direction, or procedure related to the construction site safety precautions, procedures, or methodology of the Contractor.
3. The use of a RFI is limited to clarification of the contract documents. Contractor will limit each RFI to a single issue. Information which is discernable from the contract documents; construction means and methods; product substitution submittals; product submittals; and construction site safety will not be addressed by the Architect in responding to a RFI.
4. Architect's response to a RFI is not a change order or directive authorizing an increase in construction cost or time.

B. All substitutions and Requests for Information (RFI) that affect Structural Safety, Fire-Life Safety, Access Compliance or Energy (as applicable) shall be submitted to the Division of the State Architect for review and approval.

C. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
   1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

D. Frivolous or Unnecessary RFIs: Cost of design professional's time will be billed or deducted from progress payment.

E. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
   1. Project name.
   2. Date.
   3. Name of Contractor.
   4. Name of Architect.
   5. RFI number, numbered sequentially.
   6. Specification Section number and title and related paragraphs, as appropriate.
   7. Drawing number and detail references, as appropriate.
   8. Field dimensions and conditions, as appropriate.
   9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   10. Contractor's signature.
   11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
      a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

F. Hard-Copy RFIs: Form at end of this Section.
   1. Identify each page of attachments with the RFI number and sequential page number.

G. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow 21 days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.

d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

H. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FORMS

A. Electronic versions of attached forms will be provided upon request.
1. RFI Form.
2. RFI Log.

END OF SECTION 01 31 00

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SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Submittals Schedule.
   3. Three Week Look-Ahead Schedule.
   4. Daily construction reports.

B. Related Sections include the following:
   1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or review.

B. Contractor's Construction Schedule: Submit three opaque copies of schedule, large enough (minimum 11 x 17) to show entire schedule for entire construction period.

C. Daily Construction Reports: Submit two copies at weekly intervals.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Concurrent with the development of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the submittal schedule with the Contractor's construction schedule described above.
   1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
   2. The Architect will review the schedule and indicate which submittals may be deleted from the submission requirement. The deletion of the submittal requirement for an item does not release the Contractor from any requirements of the Construction Contract, General Conditions or Plans and Specifications.

B. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
   1. Scheduled date for the first submittal.
   2. Related Section number.
   3. Submittal category.
   4. Name of subcontractor.
   5. Description of the part of the Work covered.
   6. Scheduled date for resubmittal.
   7. Scheduled date the Architect's final release or review.

C. Distribution: Following response to initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
   1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule. Submit within 15 days of the date established for "Commencement of the Work". The Construction Schedule must be submitted and accepted prior to approval of first pay application.
   1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as identified in the "Schedule of Values".
   2. Within each time bar indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.
   3. Prepare the schedule on a sheet, or series of sheets, of stable reproducible media, of sufficient width to show data for the entire construction period.
   4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
   5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
   6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating "pre-calculated" and "actual" costs. On the line show dollar-volume of work performed as of the dates used for preparation of payment requests.
   1. Refer to Section "Payment Procedures" for cost reporting and payment procedures.

2.3 THREE WEEK LOOK-AHEAD SCHEDULE

A. Prepare weekly (or as determined by scheduled meeting times), prior to Project meetings, a computer-generated 3-week look-ahead schedule (bar chart) which is consistent with the Contractors schedule and depicts daily labor activities. The schedule will consist of the prior week, current week and the following 3 weeks.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions.
   7. Accidents.
   8. Meetings and significant decisions.
   9. Unusual events (refer to special reports).
   10. Stoppages, delays, shortages, and losses.
   11. Meter readings and similar recordings.
   12. Emergency procedures.
   13. Orders and requests of authorities having jurisdiction.
   14. Change Orders received and implemented.
   15. Construction Change Directives received and implemented.
   16. Services connected and disconnected.
   17. Equipment or system tests and startups.
   18. Partial Completions and occupancies.
   19. Substantial Completions authorized.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates changes, including, but not limited to, changes in durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of reviewed schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.2 FORMS

A. Electronic versions of attached forms will be provided upon request.
1. Submittals Schedule Form.

END OF SECTION 01 32 00

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Consult individual sections of specifications for specific submittals required under those sections and for further details and descriptions of requirements.

C. Related Sections include the following:
   1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
   2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
   3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
   4. Division 1 Section "Closeout Procedures" for submitting warranties.
   5. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   6. Division 0 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   7. Division 1 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
   8. Other Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. Processing: All costs for printing, preparing, packaging, submitting, mailing, or delivering submittals for initial submittals and all costs for re-printing, re-drawing, re-drafting, re-packaging, re-submitting, and re-mailing or re-delivering as required for all re-submittals shall be included in Contract Sum.

B. Sequence: Transmit each submittal in sequence which will not result in Architect's approval having to be later modified or rescinded by reason of subsequent submittals which should have been processed earlier or concurrently for coordination.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

E. Multiple Reviews: The Contractor shall also be responsible for all costs to Architect or Architect consultants for reviews requiring more than 2 reviews for same specification section.

F. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Review: Allow 21 days for review of each submittal. Architect will request for more time if needed

G. Identification: Place a permanent label or title block on each submittal for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Each submittal number shall be unique as follows:
        1) Format shall be as follows:
            a) Sequential Number - Revision Number - Project Specification Section Number (e.g., 1-1-09910). Do not use letters.
        2) Submittal number shall be sequential starting with 1 (e.g., 1-#-#####).
        3) First submittal for each section shall have number 1 as the "revision" number. (e.g., #-1-#####)
        4) Resubmittal for same specification section shall have same first digit as the original submittal and sequential second digit revision number (e.g., #-2-##### as in second submittal).
        5) Sample submittal log would look like the following in the submittal number column: Note that 1-2-09910 is second submittal.

Submittal Number
1-1-099100
1-2-099100 (revised submittal: shown for clarity)
2-1-055000
3-1-077200

    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

H. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

I. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

J. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
   1. Transmittal Form: Use AIA Document G810.

K. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked "Approved" or "Furnish as Noted".

L. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

M. Use for Construction: Use only final submittals with mark indicating approval by Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
      a. Circle items applicable.
      b. Cross-out items not applicable.
      c. Select item number if required.
   3. Submittal data must include complete documentation relating to all the specified features
   4. Include the following information, as applicable:
      a. Manufacturer's Submittal Form with all the options selected when available.
      b. Manufacturer's written recommendations.
      c. Manufacturer's product specifications.
      d. Manufacturer's installation instructions.
      e. Standard color charts.

f. Manufacturer's catalog cuts.
g. Wiring diagrams showing factory-installed wiring.
h. Printed performance curves.
i. Operational range diagrams.
j. Mill reports.
k. Standard product operation and maintenance manuals.
l. Compliance with specified referenced standards.
m. Testing by recognized testing agency.
n. Application of testing agency labels and seals.
o. Notation of coordination requirements.

5. Submit Product Data before or concurrent with Samples.
6. Number of Copies: Submit 6 copies of Product Data, unless otherwise indicated. Architect will return 2 copies. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
a. Dimensions.
b. Do not use words "by others." Use words which depict exactly who is responsible for the work.
c. Identification of products.
d. Fabrication and installation drawings.
e. Roughing-in and setting diagrams.
f. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
g. Shopwork manufacturing instructions.
h. Templates and patterns.
i. Schedules.
j. Design calculations.
k. Compliance with specified standards.
l. Notation of coordination requirements.
m. Notation of dimensions established by field measurement.
n. Relationship to adjoining construction clearly indicated.
o. Seal and signature of professional engineer if specified.
p. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
3. Number of Copies: Submit 4 sets of prints.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of appropriate Specification Section.
   3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      a. Number of Samples: Submit 1 full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
   5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
      a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
         1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return two copies.
a. Mark up and retain one returned copy as a Project Record Document.

F. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit 2 copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

L. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed

before installation of product, for compliance with performance requirements in the Contract Documents.

N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.

Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

2.3 DEFERRED APPROVALS AND DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit 3 copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
   1. Coordinate the work; do not delegate responsibility for coordination to any subcontractor.
   2. Anticipate the interrelationship of all subcontractors and their relationship with the total work.
   3. Resolve differences or disputes between subcontractors and materials suppliers concerning coordination, interference, or extent of work between sections.
   4. Trade submittals with “By Others”, “By General Contractor”, or similar coordination and work scope are not allowed. Identify, acknowledge, and resolve scope of work

prior to submittal by Contractor. No extras will be allowed. Provide complete and coordinated submittals.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action. Submittals without the Contractors review stamp will be returned without action, no additional time will be allowed for incomplete/ returned submittals.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

F. Architect’s and Consultant’s review shall neither be construed as complete check nor relieve the Contractor, Subcontractor, manufacturer, fabricator, or supplier from responsibility for any deficiency that may exist or from any departures or deviations from the requirements of the Contract unless the Contractor has, in writing, called the Architect’s attention to the deviations at the time of submission as specified.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:
   1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
   2. Other Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work

and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups:
   1. Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
   2. Comprehensive, completely integrated mockups of separate trades showing interface conditions, transitions, and relationships between materials and finishes.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels,

comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.
   7. Entity responsible for performing tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and re-inspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A licensed professional engineer who is legally qualified to practice in California and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An DSA approved NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

B. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

C. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.

5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

E. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.
C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes list of references.

1.3 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.
B. “AHJ”: Agency having jurisdiction.
C. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
D. “Compatible”: When used for products, it shall comply with requirements including products recommended/ required by the manufacturer for warrantee acceptance.
E. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
F. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
G. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
H. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

I. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
J. "Owner": As defined in Division 1 section "Summary".
K. "Provide": Furnish and install, complete and ready for the intended use.
L. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
    1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
    2. Copies of standards and applicable building codes (Title 24 Parts 1-6 and 9) shall be kept on-site during construction.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.
E. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized names.
F. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized names.
G. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized names.

1.5 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2023) The 2022 Code of Regulations CCR, CFC, CMC, CPC, CEC Govern
   1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA)
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2020 NEC, as Amended by CA)
   5. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2021 IAPMO UPC, as Amended by CA)
   6. Title 24 CCR, Part 6 - 2022 California Energy Code
   7. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2021 IFC, as Amended by CA
   8. Title 24 CCR, Part 11 - 2022 California Green Building Standards Code (Calgreen Code)
   9. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)
   10. NFPA 101- Life Safety Code. 2021 Edition
   11. 2022 ADA Standards for Accessible Design
   12. Americans with Disabilities Act (ADA), Title II or Title III.

B. California Referenced Standards Title 24 CCR, Part 12 - 2022 (partial list)
   1. NFPA 13 - Automatic Sprinkler Systems (California Amended), 2019 Edition.
   2. NFPA 17 - Dry Chemical Extinguishing Systems, 2021 Edition.
   3. NFPA 24 - Private Fire Service Mains (California Amended), 2018 Edition.
   4. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2022 Edition (Note: See UL Standard 1971 for "Visual Devices").
   5. NFPA 80 - Fire Door and Other Opening Protectives, 2019 Edition.
   6. NFPA 101- Life Safety Code. 2021 Edition
   7. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives, 2019 Edition
   8. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies
   9. 2019 California Access Compliance Advisory Reference Manual
   10. Americans with Disabilities Act (ADA), Title II or Title III.
   11. UL 300 – Standard for Testing of Fire Extinguishing Equipment for Protection of Commercial Cooking Equipment.
   12. Ul 464 – Audible for Fire Alarm and Signaling Systems. Including Accessories
   13. UL 521 – Standard for Heat Detectors for Fire Protective Signaling Systems (2005 edition).
   14. UL 1971 Standard for Signaling Devices for the Hearing Impaired (2002-2010)
   15. Refer to 2022 CBC (SFM) Chapter 35 and California Fire Code Chapter 80 for a complete list of applicable NFA Standards.

16. 2022 California Access Compliance Advisory Reference Manual

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 **- GENERAL**

1.1 WORK INCLUDED

A. The requirements of the **Owner's** General and Supplementary Conditions, and Division 0 and Division 1 General Requirements apply to the work of this Section.

B. The **General Contractor** is responsible for all costs associated with temporary utilities during construction.

C. Temporary facilities and controls required for this Work include, but are not necessarily limited to:

1. Temporary utilities including, but not limited to;

   - Gas
   - Water
   - Electricity
   - Telephone

2. Field office.
3. Sanitary facilities.
4. Fencing of construction area.
5. Protective fencing for existing vegetation
6. Parking of vehicles.
7. Egress plan.

1.2 RELATED WORK

A. Utility hookups: pertinent Specification Sections.

PART 2 **- PRODUCTS**

2.1 TEMPORARY UTILITIES

A. General: Furnish water, gas and electricity required during construction and extend temporary service lines to construction areas for use of all Subcontractors.

B. Temporary water:

1. **General Contractor** may connect a temporary line to the existing water service lines at the site.
2. The **General Contractor** shall be responsible to verify all existing conditions associated with a water connection.
3. Connections to existing water service lines shall be coordinated with and accepted by the Project Inspector.
4. Water used in construction must comply with Section 16 of the Standard Construction Specifications.
5. Provide ample supply of potable water for all purposes of construction at point convenient to Project. Pipe water from source of supply to all points where water will be required.

6. Provide sufficient hose to carry water to every required part of construction and allow use of water facilities to Subcontractors engaged on Work.

C. Temporary electricity:

1. The **General Contractor** shall arrange for and shall install power service from electrical service provider service lines, or shall provide a portable generator.
2. Electric service: Construct all temporary electric facilities and maintain in accordance with Division of Industrial Safety "Electrical Safety Orders" (ESO), Public Utilities Commission "Rules of Overhead Line Construction" (G.O. 95), and CAL-OSHA. Materials, devices and equipment used for these facilities shall be in good and safe condition but need not be new.

D. Temporary heating: Provide heat, ventilation, fuel and services as required to protect all work and materials and to keep humidity down to extent required to prevent corrosion of any metal and to prevent dampness or mildew which is potentially damaging to materials and finishes. In addition, provide heat and ventilation prior to and during following work operations:

1. Where applicable: At all times during placing, setting and curing of concrete, provide sufficient heat and protection to insure heating of spaces involved to not less than 50ºF.
2. From beginning of application of drywall and during setting and curing period, provide sufficient heat to produce temperature in spaces involved of not less than 55ºF.
3. For period of 7 days previous to placing of interior finish materials and throughout application of finish painting and laying of resilient flooring materials, provide sufficient heat to product temperature of not less than 60ºF.
4. After finishing trades are complete and until final acceptance of Work, provide temperature of not less than 60ºF.

E. Telephone:

1. Maintain telephone in field office for use by **Architect** and **Owner** as well as **General Contractor**.
2. Provide and pay for telephone installation and service for field office. Maintain service for duration of operations under this Contract. Provide gongs, horns or remote control devices so that telephones may be heard throughout construction site.
3. **General Contractor** shall not have access to phones on site and therefore, shall arrange for their own pager or portable phone if needed for on-site communication.

F. Fax Machine:

1. Maintain fax machine in field office for use by **Architect** and **Owner** as well as **General Contractor**.
2. Provide and pay for fax machine telephone service installation and service for field office. Maintain service for duration of operations under this Contract. Provide gongs, horns or remote control devices so that telephones may be heard throughout construction site.

2.2 FIELD OFFICE

A. **General Contractor** shall provide at least one temporary field office for use by himself, their Subcontractors, and the **Architect**.

2.3 SANITARY FACILITIES

A. The **General Contractor** will provide proper, adequate, sanitary toilet facilities for use of all workers employed on Project, in accordance with State and Local health departments.

2.4 TEMPORARY CONSTRUCTION, EQUIPMENT AND PROTECTION

A. Provide, maintain and remove upon completion of Work, all temporary rigging, trench plates, scaffolding, hoisting equipment, rubbish chutes, ladders, barricades, lights and all other protective structures or devices necessary for safety of workers and public property as required to complete all Work.

B. Walkways and barricades: Provide pedestrian walkway protection and wood barricades conforming to Jurisdiction standards and requirements.

C. Temporary fencing: Provide chain link fencing enclosures around unfenced areas of the site as required to protect pedestrians until project is complete.

D. Protection: Protect all workers and equipment from power lines and maintain safe distances and protective devices as required by Industrial Safety Commission and CAL-OSHA.

E. Temporary construction and equipment: All temporary construction and equipment shall conform to all regulations, ordinances, laws and other requirements of State and other authorities having jurisdiction, including insurance companies, with regards to safety precautions, operation and fire hazard.

F. Pumping: Provide and maintain pumping facilities, including power for keeping site, excavations and structures free of accumulations of water at all times, whether from underground seepage, rainfall, drainage or broken lines. Pond discharge to get rid of sediment prior to discharge into storm drain.

G. Damage or theft: Protect work and materials to be used on Project from damage or loss due to elements, theft, vandalism, malicious mischief, or other causes. **General Contractor** shall be held responsible for such damages or loss which he shall remedy at their expense.

H. Provide fencing to maintain means of egress in and out of building and site.

2.5 PARKING OF VEHICLES

A. **General Contractor** shall be responsible for job site vehicle parking of their Subcontractor's vehicles.

PART 3 **- EXECUTION**

3.1 MAINTENANCE AND REMOVAL

A. Maintain all temporary facilities and controls as long as needed for safe and proper completion of Work; remove all such temporary facilities and controls as rapidly as progress of Work will permit.

END OF SECTION 01 50 00

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SECTION 01 5813 – TEMPORARY CONSTRUCTION SIGNAGE

PART 1 - **GENERAL**

1.1 PRINCIPAL WORK IN THIS SECTION

A. The requirements of the **Owner's** General and Supplementary Conditions, and Division 0 and Division 1 general requirements apply to the work of this Section.

B. [illegible]

C. Verify applicable dimensions at the job site for placement of temporary signage.

D. Wood framing, including posts, sheathing.

E. Finishing, including painting of substrate and letters and numerals for signage.

F. Framing hardware.

G. Concrete Footings with integral gravel base.

H. Disposal of sign assembly after **Owner** occupation of building.

1.2 QUALITY ASSURANCE

A. Lumber and plywood source quality control: Provide materials graded under one of the following:

1. Rules 17, Standard Grading Rules for West Coast Lumber, current edition - WCLIB.
2. Standard Grading Rules for Western Lumber, current edition - WWPA.
3. Plywood Specification and Grade Guide of American Plywood Association, current edition - APA.

B. Grade mark each piece of lumber. Marking must be done by recognized agency. Lumber Manufacturer's Association Certificates may be accepted in lieu of such grade and trademarks.

C. Plywood sheathing: Each panel shall be legibly identified as to type, grade and species by APA grade, comply with PS-1 (ANSI A199.1).

1.3 SUBMITTALS

A. Refer to Division 1 for substitution, deviation and/or submittal procedures.

B. List of materials: Submit list of materials proposed to be used including posts, sheathing & hardware.

C. Submit: Shop drawings of sign & anchorage. Sign layout shall indicate character sizes, style & spacing, type.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Division 1 product delivery, storage and handling requirements.

B. Provide, ship to project site, and install.

PART 2 - **PRODUCTS**

2.1 FRAMING LUMBER

A. Lumber: Coast Region Douglas Fir (DF), unless otherwise noted. Lumber designated DF South by WWPA not acceptable. All lumber new with no re-use.

1. Grades not less than following:

a. Posts: No. 1, Pressure treated Douglas fir - free of heart center.
b. Plywood: Group II Exterior APA 303 Siding EXT, Smooth Face.

B. All wood other then plywood shall be pressure treated, per building code, Chapter 23 and shall bear an AWPB stamp for P.T.D.F.

1. Wood posts set into ground.

a. Treat all cut ends of P.T.D.F. with approved preservative.

2.2 ROUGH HARDWARE

A. FASTENERS: Galvanized for exterior use, in accordance with ASTM A153. Select fasteners for the fastening of the plywood substrate sign to the support posts.

1. Standard bolts and nuts: Carriage head type, ASTM A307, Grade A.
2. Plain washers: Round, general assembly grade carbon steel, FS FF-W-92.
3. Lock washers: Helical spring type carbon steel, FS FF-W-84.

2.3 SIGNAGE DESIGN

A. General

1. Size of sign panel: 4'-0" x ¾" thick x 8'-0" long
2. Supporting Posts: 4" x 4" x 10'-0"

B. Sign design:

1. General:

a. Refer to Drawings detail.

2. Characters:

a. Style: Helvetica
b. Type: Capitals
c. Border: Install characters, logos, etc. such that an equal clear border of 2" occurs around perimeter.
d. Character height::

1. Project Name: 4" tall x two lines & spaced to span sign width
2. Project Address: 3" tall x full width of sign less perimeter clearance
3. **Owner**, **Architect** & **General Contractor** name: 2" tall
4. **Owner**, **Architect** & **General Contractor** address: 1-1/2" tall

e. Line spacing:

1. 1" between name & address, type.
2. Equally spaced between Project name/address & **Owner** name/address, etc.

3. Color:

a. Background: ICI, 473, Autumn Squash, MP# 10YY 46/515
b. Characters: Jet Black
c. Misc: Install 1/4" dots spaced at 2"+/- on center below Williams + Paddon... name. Red, PPG Color no: 71654
d. Paint Type: Alkyd Enamel
e. Finish: High Gloss

PART 3 - **EXECUTION**

3.1 INSTALLATION

A. General:

1. Install posts straight, true, level, plumb, and place 4'-0" into 12" diameter x 3'-8" deep concrete footing. - extend 4" of post into clean gravel at base of footing.
2. Fasten sign panel to posts with (3) carriage bolts each post & spaced evenly from bottom of sign to top.
3. Install sign assembly such that top of posts are located 2" below top of sign panel & 2" measured from side of sign panel.

B. Bracing:

1. Provide temporary bracing sufficient to keep structure stable, plumb, and in line until completed.

END OF SECTION 01 58 13

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and product substitutions.

B. Related Sections include the following:
   1. Division 1 Section "References" for applicable industry standards for products specified.
   2. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   3. Other Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Proposed products by manufacturers not listed in Manufacturers list.

C. Basis-of-Design: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating "or equal" products of other named manufacturers.

D. District Standard: Where a specific manufacturer's product is named and accompanied by the words "District Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics pre-selected by the District.

1. District seeks to match products currently in use on other campuses; No substitution allowed.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:
   a. Specification Section number and title.
   b. Generic name used in the Contract Documents.
   c. Proprietary name, model number, and similar designations.
   d. Manufacturer's name and address.
   e. Supplier's name and address.
   f. Installer's name and address.
   g. Projected delivery date or time span of delivery period.
   h. Identification of items that require early submittal approval for scheduled delivery date.
3. Completed List: Submit 3 copies of completed product list within days specified in General Conditions. Include a written explanation for omissions of data and for variations from Contract requirements.
4. Architect's Action: Architect will respond in writing to Contractor within 21 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: (REFER TO SECTION 2.2 FOR ADDITIONAL SUBSTITUTION REQUIREMENTS) Submit 4 copies of each request for consideration. Identify product

or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided at end of Section.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, environmental, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: Architect will notify Contractor of acceptance or rejection of proposed substitution within 21 days of receipt of request.
    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. All substitutions affecting the Structural, Access or Fire-Life Safety portions of the project shall be submitted to DSA for approval as a Construction Change Document Submittal and Approval Process (Title 24, Part 1, California Code or Regulations, Section 4-338) requirements.
D. The cost for any additional design or engineering required to gain DSA approval of a substitution shall be borne solely by the contractor. Any delay impacts resulting from DSA review and approval of substitutions shall be borne solely by the contractor.
E. Named Product and Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.
F. District Standard Products Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Reference Standards: The 2022 Code of Regulations CCR, CFC, CMC, CPC, CEC Govern
   1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA)
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2020 NEC, as Amended by CA)
   5. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2021 IAPMO UPC, as Amended by CA)
   6. Title 24 CCR, Part 6 - 2022 California Energy Code
   7. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2021 IFC, as Amended by CA
   8. Title 24 CCR, Part 11 - 2022 California Green Building Standards Code (Calgreen Code)
   9. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)
   10. NFPA 101- Life Safety Code. 2021 Edition
   11. 2022 ADA Standards for Accessible Design
   12. Americans with Disabilities Act (ADA), Title II or Title III.

B. Changes to the approved drawings and specifications shall be made by an addendum or a Construction Change Document approved by the Division of the State Architect, as required by Section 4-338, Part 1, Title 24, CCR.

C. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
   1. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Store cementitious products and materials on elevated platforms.
   5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   7. Protect stored products from damage and liquids from freezing.
   8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
   3. Refer to other sections for specific content requirements and particular requirements for submitting special warranties.

C. Warranty Period: Warranty period specified in each sections are minimum requirements. Do not modify manufacturer’s standard warranty period if the manufacturer’s warranty has longer warranty period.

D. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or an equal product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with “or equal”.
6. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Product Substitutions" Article to obtain approval by Architect for use of an unnamed product.
7. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
8. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include custom or premium items.

b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes standard, custom, and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 35 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction and has paid any fees.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
11. Furnish samples upon requested by Architect.
12. Attached Request for Substitution Form shall used for substitution requests.

C. Substitutions for products or systems involving structural, fire/life safety and access compliance will be considered a Construction Change Document or Addendum, and will require DSA approval. This will add time required to review those substitutions

requiring DSA approval. Contractor is solely responsible for all documentation and time required to obtain DSA approval.

1. The use of a product other than specified or noted on the Drawings will require the Contractor to get Engineer, Architect and DSA approval.
2. The Contractor shall be responsible to provide any information, calculations or drawings to show compliance with the DSA approved drawings and provide all documentation to the Architect and/or Engineer of record.
3. Any changes or "substitutions" that impact or relate to DSA requirements for structural, ADA or fire and life safety MUST be approved by DSA prior to proceeding with the work.
4. The Contractor shall also be responsible for all costs to the DSA, Architect or Architect consultants for review, co-ordination, and approval by the DSA.
    a. All costs for submittal to DSA and Architect/ design team expenses shall be back charged to the Contractor.

PART 3 - EXECUTION

3.1 FORMS

A. Electronic versions of attached forms will be provided upon request.
    1. Product List Form.
    2. Similar Installation List Form.
    3. Substitution Request Form.

END OF SECTION 01 60 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.
B. Related Sections include the following:
   1. Divisions 2 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
   1. Extent: Describe cutting and patching, show how they will be performed.
   2. Products: List products to be used and firms or entities that will perform the Work.
   3. Dates: Indicate when cutting and patching will be performed.
   4. Utility Services and Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
   5. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Cutting, boring, saw cutting or drilling through the new or existing structural elements to be done only when so detailed in the drawings or accepted by the Architect and Engineer with the approval of DSA Representative.
B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
D. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
E. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.
B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
    1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut where required for safety and to prevent unnecessary damage to existing components.
B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size

required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable spec sections where required by cutting and patching operations.
5. Plumbing and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Disposing of nonhazardous construction waste.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for environmental-protection measures during construction.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work.

1.5 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for the Notice to Proceed.
B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) in tons.
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
D. Qualification Data: For Waste Management Coordinator.
E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.

3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
    1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
    2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
    3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Architect. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
    1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
    1. Distribute waste management plan to everyone concerned within three days of submittal return.
    2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
    1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
    2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.
B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
    1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
        a. Inspect containers and bins for contamination and remove contaminated materials if found.
    2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
    3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
    4. Store components off the ground and protect from the weather.
    5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.
C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. IOR's Inspection procedures.
   2. Warranties.
   3. Extra Materials.
   4. Final cleaning.
   5. DSA project closeout and Final Certification of Construction.
   6. Title 24 Certificate of Acceptance requirements.

1.3 DEFINITIONS

A. IOR: Inspector of Record.
B. Inspection: IOR will inspect, not the Architect.

1.4 SUBMITTALS

A. Submit a copy of Title 24 Certificate of Acceptance forms submitted to enforcement agency.

1.5 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting IOR's inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. IOR's Inspection: Submit a written request for IOR's inspection for Substantial Completion. On receipt of request, Architect will either proceed with IOR's inspection process or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after IOR's inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.6 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final IOR's inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
   2. Submit certified copy of Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified

copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. IOR's Inspection: Submit a written request for final IOR's inspection process for acceptance. On receipt of request, Architect will either proceed with IOR's inspection process or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after IOR's inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use form attached.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

B. NOTE: The punch list does not relieve the Contractor(s) of and of the Contract requirements noted in the specifications and construction documents

1.8 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date specified in General Conditions.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Include Table of Contents.
   3. Identify content with specification section number and title.
   4. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   5. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

1.9 EXTRA MATERIALS

A. Deliver to Owner's facility manager extra materials specified in each section.
B. Organize submitted materials in orderly sequence based on the table of contents of the Project Manual.
   1. Itemize each material and quantity in 8-1/2 by 11-inch paper.

C. Label each item for easy identification.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting IOR's inspection for certification of Substantial Completion for entire Project or for a portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Sweep concrete floors broom clean in unoccupied spaces.
      i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
      j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
      k. Remove labels that are not permanent.
      l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
         1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
      m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
      n. Replace parts subject to unusual operating conditions.
      o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

3.2 DSA PROJECT CLOSEOUT AND FINAL CERTIFICATION OF CONSTRUCTION

A. Verified Reports: Per Title 24 Part1, Section 4-336.
B. Final Certificate of Construction: Per Title 24 Part1, Section 4-339.
C. Duties of Contractor: Per Title 24 Part1, Section 4-343.

3.3 FORMS

A. Electronic versions of attached forms will be provided upon request.
   1. Punch-List Form.

END OF SECTION 01 77 00

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SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections include the following:
   1. Division 1 Section "Closeout Procedures" for general closeout procedures.
   2. Division 0 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Other Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit 1 set of marked-up Record Prints.

B. Record Specifications: Submit 1 copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit 1 copy of each Product Data submittal.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order Documents.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.
   3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
   4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
   5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
   4. Assemble in single binder with table of contents.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

3.2 FORMS

A. Electronic versions of attached forms will be provided upon request.
   1. Record Product Data Form.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 SUBMITTALS

A. Instruction Program: Submit 2 copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. At completion of training, submit 1 complete training manual(s) for Owner's use.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 79 00

SECTION 01 81 19 - CONSTRUCTION INDOOR AIR QUALITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Temporary construction ventilation, dust protection, preconditioning of materials, protection of materials, sequencing, duct protection, and duct cleaning to insure good indoor air quality after occupancy to be performed by the CONTRACTOR.

B. Related Sections:

1.2 REFERENCES

A. SMACNA - IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3.

B. ASHRAE Standard 52.2-1999 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved)

1.3 CLASSIFICATION OF RELEVANT MATERIALS

A. VOC-Emitting Materials
   1. Section 06 41 00, Architectural Wood Casework
      a. Adhesive applied on-site
      b. Composite wood products containing added urea-formaldehyde
   2. Section 07 25 00, Weather Barriers
      a. Adhesives
      b. Sealants
   3. Section 07 92 00, Joint Sealers
      a. All joint sealers applied on-site on the interior side of the building envelope
   4. Section 09 21 16, Gypsum Board Assemblies
      a. Adhesives
      b. Sealants
   5. Section 09 30 13, Ceramic Tile
      a. Adhesives and joint sealers applied on-site on the interior side of the building envelope
      b. Sealants
   6. Section 09 65 19, Resilient Flooring

a. Adhesives
b. Sealants

7. Section 09 91 00, Painting and Coatings
   a. Painting
   b. Coatings

B. Porous and Fibrous Materials
   1. Batt insulation (exposed to interior only)

1.4 SUBMITTALS

A. Submit eighteen (18) photographs documenting compliance with this Section. Provide six (6) photographs each at three (3) different phases of construction.

B. Contractor shall develop and submit to the Architect for review the Construction Indoor Air Quality (IAQ) Plan as required in this Section. A template form is provided Appendix A of this Specification. The plan shall be submitted along with the first submittal for any of the products listed above.

1.5 SUBSTITUTIONS

A. Construction Indoor Air Quality (IAQ) requirements described below are based upon practices described in SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 1995. Any modifications to or substitutions of requirements described in this Section must comply with the abovementioned SMACNA guideline.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

A. Inspection: Contractor shall conduct inspections to confirm that construction IAQ measures proposed in the Construction IAQ Plan are being followed, and be prepared to report compliance with the Plan at progress meetings.

3.2 PROJECT CONTITIONS

A. Air Filtration:
   1. Systems designed with particle filters shall not be operated without filters in place. Temporary construction filters shall have a minimum MERV rating of 8.
   2. Replace all air filtration media immediately prior to occupancy. Post-construction air filters shall have a minimum MERV rating of 13.

B. Construction Ventilation: Following building enclosure, maintain continuous temporary ventilation of areas during installation of VOC-Emitting Materials identified in this Section. Construction Ventilation shall be provided for post-occupancy touch-up work involving VOC-Emitting materials. It is not required during Building Flush-Out.
   1. Ventilation shall be supplied via open windows and doors, temporary ducts, and temporary fans, sufficient to provide no less than three (3) air changes per hour.
   2. When continuous ventilation is not practical via temporary fans and exhaust to outside, then ventilation shall be supplied via the building's HVAC system and shall comply with the following requirements:
      a. Provide temporary air filters at return air grilles.
      b. Provide 100% outside air. Relative humidity not to exceed 60%.
      c. Provide a minimum of three {3) air changes per hour.
   3. Maintain continuous ventilation for a minimum period of 72 hours after installation of VOC-Emitting Materials, unless otherwise indicated elsewhere in these Specifications.
   4. Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.

C. Preconditioning: Prior to installation, allow contractor-furnished contractor-installed VOC-Emitting Furnishings and Equipment as identified in paragraph 1.04 of this Section to off-gas in dry, well-ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions
   1. Remove containers and packaging to maximize off-gassing of VOCs.
   2. Precondition products in ventilated warehouse or other ventilated building. Preconditioning at the project site is acceptable, provided that Temporary Construction Ventilation and Sequencing measures are taken as described elsewhere in this Specification.
   3. Products requiring preconditioning include, at minimum, contractor-furnished and contractor-installed VOC-Emitting Furnishings and Equipment that contain vinyl or other flexible plastics, resins, adhesives, foam rubber, and fiberboards with urea-formaldehyde binders. Products bearing Greenguard certification (www.greenguard.org) shall be excluded from the preconditioning requirement.

3.3 SEQUENCING

A. On-Site Application: Where VOC-Emitting Materials as identified in this Specification are applied on-site, apply prior to installation of Porous and Fibrous Materials as identified as a part of this Specification. Maintain continuous ventilation for a period of 72 hours before installation of porous and fibrous materials.
   1. Where this sequencing requirement is not possible, protect porous materials with polyethylene vapor retarders. Tape all polyethylene edges to insure a complete seal. Maintain continuous ventilation per temporary construction ventilation requirements described above for a period of 72 hours before removing polyethylene.

B. Completion: Complete interior finish material installation prior to Building Flush-Out as described in this Section.

3.4 PROTECTION

A. Moisture Protection: Protect interior materials from water intrusion or penetration as described in Section 01 60 00 Product Requirements.
   1. Porous or fibrous materials with visible microbial growth shall not be installed.
   2. Non-porous materials with visible microbial growth shall be decontaminated.

B. Duct Protection: during dust-producing activities (e.g. sanding, cutting, or grinding), or when VOC-Emitting Materials are being installed, implement the following measures:
   1. If possible, damper off the return (negative pressure) side of HVAC air distribution system and seal return system openings with polyethylene sheet.
   2. If HVAC system must be operated during dust-producing activities, provide temporary construction air filters with a minimum MERV rating of 8 at all return air grilles.
   3. If HVAC supply air is off, protect diffusers and openings with polyethylene sheet.

3.5 CLEANING

A. Provide the following cleaning in addition to requirements described in Section 01 70 00 Execution Requirements:
   1. Clean all coils, air filters, and fans prior to Testing and Balancing.
   2. If significant dust collection is observed at diffusers, return air grilles, or in ducts, clean prior to system start-up.

3.6 BUILD FLUSH-OUT

A. Just prior to Substantial Completion, but following Testing and Balancing, flush out building using the building HVAC system, maintaining a minimum temperature of 60° F and maximum 60% relative humidity. Provide a total of 14,000 cubic feet of outside air per square foot of floor area building flush out as follows:
   1. Prior to building occupancy, provide 3,500 cubic feet of outdoor air per square foot of floor area.
   2. Following building occupancy, provide a minimum ventilation rate of 0.30 cfm/sq. ft. of outside air or the design minimum outside air rate, whichever is greater. Maintain these conditions beginning a minimum of three (3} hours prior to daily occupancy and extending through daily occupancy hours, until the remainder of the 14,000 cfm of outside air per square foot of floor area is achieved.

B. Insure that MERV 13 air filters are in place during Building Flush-Out.

C. Installation of furniture and equipment may occur during Building Flush-Out.

D. Return ventilation system to normal operation following Building Flush-Out period to minimize energy consumption.

E. Immediately following Building Flush-Out, replace air filters with new MERV 13 air filters. Air filters that handle solely outside air need not be replaced.

END OF SECTION 01 81 19

APPENDIX A

CONSTUCTION INDOOR AIR QUALITY (IAQ) PLAN

CONTRACTOR [CONSTUCTION MANAGER]:

Name: _____ Title: _____

Telephone: _____ Fax: _____

Email: _____

I have read and understood and will implement the following Construction IAQ Plan:

Signature _____ Date: _____

1. CONSTRUCTION VENTILATION

List all project materials requiring Construction Ventilation per Specification Section 01 81 19. Attach additional sheet if necessary.	
Y / N	Ventilation will be supplied via open windows, temporary ducts, and temporary fans. If "Y", then supply air diffusers, return air grilles, and/or open ducts will be sealed.
Y / N	Ventilation will be supplied via area exhaust fans. If "Y", check applicable: ☐ Supply air diffusers, return air grilles, and/or open ducts will be sealed. Make-up air will be provided through open windows or doors or other transfer air devices. ☐ HVAC system will provide make-up air. Return air grilles will be sealed.
Y / N	Ventilation will be supplied via building's HVAC system. If "Y", check applicable: ☐ Return air grilles are sealed. Exhaust is provided via open windows or doors.

	☐ Return air grilles are used for exhaust. HVAC will provide 100% outside air. Air filters with a minimum MERV rating of 8 will be provided at return air grilles.
☐ Required	Areas will be ventilated directly to outside. No ventilated air will be returned.
☐ Required	Ventilation will provide no less than three air changes per hour.
☐ Required	Ventilation will be continuous for a period no less than 72 hours after completion of installation.
☐ Required	All filtration used during Construction Ventilation will be replaced prior to Substantial Completion.

2. PRECONDITIONING

List all project materials requiring Construction Ventilation per Specification Section 01 81 19. Attach additional sheet if necessary.	
Y / N	Preconditioning will occur in dry and well-ventilated offsite location. If "Y": Where is the offsite location?
Y / N	Preconditioning will occur onsite. If "Y", check applicable: ☐ Ventilation will be supplied via open windows, temporary ducts, and tern- porary fans. See l.2a above. ☐ Ventilation will be supplied via area exhaust fans. See l.2b above. ☐ Ventilation will be supplied via building's HVAC system. See l.2c above.
☐ Required	Containers and packaging will be removed prior to Preconditioning.
☐ Required	Preconditioning will occur for fourteen (14) continuous days prior to installation.

3. SEQUENCING

List all project materials requiring Construction Ventilation per Specification Section 01 81 19. Attach additional sheet if necessary.	
☐ Required	Previously installed Porous or Fibrous Materials located in a room where VOC- Emitting Materials are to be installed will be protected with polyethylene vapor retarder. Polyethylene will not be removed until completion of a 72-hour ventilation period.
☐ Required	Installation of interior finish materials will complete fourteen (14) days prior to SuBstantial Completion.

4. PROTECTION

List all project materials requiring Construction Ventilation per Specification Section 01 81 19. Attach additional sheet if necessary.	
☐ Required	Porous or Fibrous Materials with visible microbial growth shall not be installed.
☐ Required	Materials that are not defined as Porous or Fibrous with visible microbial growth shall be decontaminated prior to installation.
☐ Required	Temporary ventilation will be provided during all dust producing activities. See Item I Construction Ventilation above. All supply air diffusers and return air grilles will be covered.
☐ Required	Ducts will be sealed during transportation, delivery, and construction.

END OF APPENDIX A

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SECTION 01 81 22 - ACOUSTICAL PERFORMANCE REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section is the primary source of acoustical performance requirements in the project documents. Should conflicts arise between the requirements in this section and other portions of the contract documents, the requirements in these sections shall take precedence, unless otherwise directed by the Architect. Under no circumstances, however, shall the requirements in this section take precedence over code or life safety requirements.

1.2 RELATED SECTIONS

A. Section 01 81 23 – Noise and Vibration Control

1.3 REQUIRMENTS

A. Specific interior acoustical environments shall be provided, including sound-absorbing finishes to control reverberation, etc. See subsequent paragraphs in this Section for further requirements.

B. Upgraded demising construction shall be provided, including extra heavy construction and components surrounding most project spaces to insure appropriate levels of sound isolation, privacy or noise control. Refer to architectural wall, window, door, ceiling, and roof requirements and airtight detailing requirements in the project drawings and specifications and subsequent paragraphs in this Section for further requirements.

C. Noisy building service spaces (mechanical equipment, duct shafts, electrical equipment, toilet rooms, etc.) shall be built to provide upgraded sound isolation to surrounding, occupied spaces.

D. All construction surrounding all spaces on the project shall be constructed airtight, as described in this section and in the project drawings.

E. A minimum of 1” clearance shall be provided between double stud walls.

F. Wherever multiple layers of 5/8" gypsum board are scheduled at partitions or at ceilings, joints between gypsum board panels shall be staggered.

G. All framed or furring walls shall be constructed full-height and include sound control batt insulation full depth (but not compressed) in stud cavities.

H. Quiet building systems shall be provided, including special HVAC systems and noise control in most project spaces to insure appropriately quiet spaces. Refer to duct layouts and equipment support requirements in the mechanical and electrical drawings and specifications and Section 01 81 23 for specific requirements.

I. Entry/exit doors to most project spaces shall include mechanically-applied head and jamb gasketing as described in the door hardware schedule.

PART 2 – PRODUCTS

2.1 ACOUSTICAL PRODUCTS - Refer to specific requirements in this section and in the Project Documents for the following:

A. General Sound Absorbing Finishes: Refer to specific requirements in the Project Documents.

B. Sound Absorbing Ceilings for Classrooms and Teaching Spaces: Minimum NRC of 0.70 and minimum CAC of 35.

C. Black-Faced Insulation for Use Above Acoustically-Transparent Ceiling Systems: Minimum 1" thick and minimum NRC of 0.70.

D. Sound Absorbing Wall Panels: Where scheduled or shown in the Project Documents. Minimum NRC of 0.80 for nominal 1" thick panels and minimum NRC of 0.95 for nominal 2" thick panels.

E. Noise and Vibration Control Products: Refer to specific requirements in Section 01 81 23 and in other portions of the Project Documents.

2.2 AIRTIGHT CONSTRUCTION DETAILING

A. All spaces on this project are designated "airtight" for the purposes of sound isolation and noise control.

B. Any interior construction that contains or includes insulation for the purposes of sound isolation shall also be designated "airtight."

C. The requirements for airtight construction include, but are not limited to, the requirements described herein and the details shown in the project drawings. All necessary products and detailing shall be provided to achieve airtight / leakproof construction, whether or not those products or details are specifically described or shown in the Project Documents.

D. Every precaution shall be taken to maintain construction completely airtight around all of the rooms on the project. Construction joints, structural penetrations, mechanical and electrical duct penetrations, pipe and conduit penetrations, electrical boxes and fixtures, cabinets, doors, access panels, windows, frames, supports, etc. all shall be built and installed in such manner as to prevent sound transmission. Provide lintels, extra frames, blocking, escutcheons, grouting, gaskets, packing, caulking, dense putties, taping, filling, etc. as required to stop sound transmission.

E. Applicable standards include ASTM E497 (Standard Practice for Installing Sound-Isolating Lightweight Partitions) and ASTM C919 (Practice for Use of Sealants in Acoustical Applications). In general:
1. Extend construction to a minimum of 1/8" and a maximum of 1/2" of adjacent construction or penetrations to provide a suitable space for packing and caulking.
2. Cut openings in construction accurately for electrical boxes, piping, ductwork and other penetrating elements. Leave enough space around such elements so they remain free of rigid connection with the surrounding construction.
3. Prior to packing and caulking penetrations as detailed herein, verify that all penetrating elements such as piping and ductwork are free and clear of the opening to be packed and caulked.
4. Where multiple layers of gypsum board are used, stagger all joints in adjacent layers a minimum of 24".
5. Apply all acoustical sealants and caulks in accordance with the manufacturer's instructions.

F. Representative details for airtight penetrations, recessed elements, edges, etc. are shown in the project drawings. Some of these are also described below:
1. Partition Bases: Provide 1/4" (high) continuous bead of acoustical sealant at all locations where gypsum board meets structural flooring. The depth of the sealant shall equal the thickness of the gypsum layer or layers.
2. Partition Heads: Provide the same detail as for bases at flat structure. Provide details in the project drawings for other conditions.
3. Partition or Ceiling Joints at Dissimilar Materials: Provide 1/4" continuous bead of acoustical sealant at all locations where gypsum board meets

dissimilar material. The depth of the sealant shall equal the thickness of the gypsum layer or layers.

4. Partition/Partition or Partition/Ceiling Joints: Provide standard corner taping detail.
5. Pipe, Duct, Conduit, or Structural Penetrations: Provide 1/4" wide bead of acoustical sealant around perimeter of small penetrating elements with controlled openings. Provide details in the project drawings for other conditions. The depth of the sealant shall equal the thickness of the gypsum layer or layers.
6. Electrical or any other Recessed/Semi Recessed Boxes 4"x 4" or Under: Provide 1/4" wide bead of acoustical sealant around perimeters of electrical boxes. The depth of the sealant shall equal the thickness of the gypsum layer or layers. Provide sheet caulking continuously around the back side of boxes.
7. Electrical Boxes or any other Semi Recessed/Recessed Boxes Over 4"x 4": Provide one layer of 5/8" gypsum board continuous around the back of such boxes. Caulk or tape all joints and caulk all conduit penetrations with acoustical sealant.

G. The Contractor shall be alert for additional conditions that may require special details or materials in order to achieve airtightness and shall bring these to the attention of the Architect.

PART 3 – EXECUTION

3.1 COMMISSIONING FOR ACOUSTICAL PERFORMANCE

Refer to Section 01 81 23 for testing and reporting requirements for building systems noise in all spaces.

END OF SECTION 01 81 22

SECTION 01 81 23 - NOISE AND VIBRATION CONTROL

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section is the primary source of requirements for noise and vibration control in the project documents. Should conflicts arise between the requirements in these sections and other portions of the contract documents, the requirements in these sections shall take precedence unless otherwise directed by the Architect. Under no circumstances, however, shall the requirements in these sections take precedence over code or life safety requirements.

1.2 RELATED SECTIONS

A. Section 01 81 22 – Acoustical Performance Requirements

1.3 REQUIRMENTS

A. Objectionable noise and vibration caused by building systems shall be reduced to levels as close as possible to the maximum allowable noise and vibration criteria required in this section. All necessary adjustments and retesting of equipment and systems to achieve the criteria shall be provided at no cost to the Owner.

1.4 MAXIMUM ALLOWABLE NOISE CRITERIA FOR PROJECT SPACES

A. Maximum allowable background noise levels in project spaces due to operation of HVAC, plumbing or electrical equipment are listed below.

Spaces	Required Background Noise Level
Classrooms, Conference Rooms, Dean's Suite Offices	`30
Private Offices, Multi-Person Offices, Counseling Offices, Reception Areas, Social Club, Break Rooms, Exam Rooms, Teaching Labs	35
Open Computer Lab, Lobby, Bookstore, Cafeteria, Corridors, Copy/Mail, Workrooms, Storage Rooms	40
Toilet Rooms, Lockers, Food Serving	45
Kitchen	50

B. Should the noise levels in any room exceed the above criteria, the Contractor shall be responsible for rebalancing, adjusting, or retesting required to meet the criteria, at no additional cost to the Owner.

1.5 MAXIMUM ALLOWABLE VIBRATION CRITERIA FOR ROTATING EQUIPMENT

A. Rotating devices shall be balanced according to the schedule below. The following vibration displacement levels shall not be exceeded when the equipment is rigidly grounded to structure (with the isolators blocked or "grounded out.")

Equipment Type	RPM	mils peak to peak (max)
Fans	< 600	4
	600 to 999	3
	1000 to 2000	2
	> 2000	1
Pumps	1800	2
	3600	1

B. Should any rotating equipment cause vibration exceeding the above criteria (or manufacturer's specifications), the Contractor shall be responsible for rebalancing, realignment, adjusting, or retesting required to meet the criteria, at no additional cost to the Owner.

1.6 SOUND POWER LIMITS FOR AIRHANDLING EQUIPMENT

A. The sound generating characteristics of air handling units shall be tested to, and comply with, all requirements of this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has previous certified test results that can be made applicable to this project.

B. Submit complete acoustical test reports showing that proposed air handling units have been tested in accordance with the latest versions of AMCA Standard 300, Test Code for Sound Rating, and AMCA Standard 301, Method for Calculating Fan Sound Ratings from Laboratory Test Data.

C. Sound power levels for all air handling equipment shall not exceed the levels of the equipment used as the basis of design for this project.

D. Should sound power levels exceed those used as basis of design, the Contractor shall arrange and pay for remedial noise control analysis, system redesign, and necessary additional noise control components at no additional cost to the Owner.

1.7 NOISE CONTROL FOR AIRHANDLING EQUIPMENT

A. Heavy Gauge Ductwork: 18 gauge ductwork shall be provided near air handlers in locations shown and as scheduled in the Project Documents.

B. Duct and Plenum Lining:
1. 2″-thick lining shall be provided in ductwork and plenums near air handling equipment in locations shown and as scheduled in the Project Documents.
2. 1″-thick lined ductwork shall be provided in all indoor SA and RA ductwork, except where 2″ lining or acoustical flexible duct is scheduled.
3. Minimum 5′ long, 1″ thick lined runouts or acoustical flexible duct shall be provided between dampers and SA outlets or RA intakes in all project spaces rated at NC-35 or below.

C. Turning Vanes: Turning vanes shall be provided in initial elbows in SA and RA mains for all air handling equipment.

1.8 NOISE CONTROL FOR GRILLES, REGISTERS, AND DIFFUSERS

A. Noise generation from grilles, registers, and diffusers shall be comply with all requirements of this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has certified test results for proposed products.

B. Submittals shall be made in accordance with the following:

1. Submit complete acoustical test reports showing that proposed products have been tested in accordance with latest editions of ASHRAE Standard 70 and ADC Standard 1062:GRD-84 and meet the maximum allowable noise criteria (NC) and A-level requirements specified above. Alternate test standards may be substituted for the above if approved in advance by the Architect.

2. Submit a tabulation of proposed products, maximum allowable noise criteria, and product noise criteria (at specified air volumes) for all project spaces.

1.9 NOISE CONTROL FOR LIGHTING SYSTEMS

A. Noise levels emanating from specified lighting equipment shall not exceed the maximum noise level requirements of this specification. A special test for this project is not required if the manufacturer has previous experience with similar installations.

B. Submittals shall be made in accordance with the following:
1. Submit complete acoustical test reports showing that proposed products have been tested for suitable operation in Project spaces with specified maximum noise criteria (NC) requirements.
2. Submittals shall include a tabulation of proposed products, identification of Project spaces where proposed products are to be installed, maximum allowable NC for all Project spaces, and product NC for all Project spaces.

1.10 VIBRATION CONTROL FOR HVAC SYSTEMS

A. Vibration or noise from HVAC equipment and systems shall not be transmitted to building structure or components, including, but not limited to, roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.
1. Furnish all labor, equipment, and components necessary for HVAC equipment and system vibration control, including, but not limited to vibration isolators, bases, seismic restraints, incidental equipment, and related materials. Assure that deflection, stability, and seismic restraint requirements are met. Install, test, and adjust all vibration isolation equipment per the manufacturer's instructions.
2. Isolator and spring static deflections are based on typical, anticipated equipment characteristics, particularly rpm. The Manufacturer shall evaluate the equipment and propose appropriate or alternate static deflections, as necessary.
3. The Manufacturer shall be responsible for all vibration isolation and seismic control equipment and have no less than five years experience in fabrication and delivery of such equipment.
4. The seismic resistance capability of all equipment shall be certified by a registered professional engineer in the state in which the project resides. The requirements of all applicable codes shall be met.

B. Ensure that functional integrity, structural integrity, and warrantees of HVAC

equipment and systems are not compromised by installation of vibration isolation equipment.

C. Satisfy the requirements of all applicable codes.

D. The vibration isolation equipment Manufacturer's responsibilities shall include the following.
1. Provide written installation instructions to the Contractor.
2. Provide necessary visits to the jobsite before and after equipment is installed to identify pre-installation issues and post-installation discrepancies and necessary corrective work.

E. The Contractor's responsibilities shall include the following.
1. Rigorously avoid short-circuiting of vibration-isolated HVAC equipment and systems to building structure and components. Oversee all trades to prevent the short-circuiting of any vibration isolation system and bring conflicts to the Architect's attention.
2. Remove temporary blocking washers and shims after equipment installations are complete and HVAC equipment and systems are at operation weight.
3. Obtain "rough-in" and final inspections by the Manufacturer and/or Architect prior to any permanent closure or covering.
4. All installations that are deemed defective in workmanship or materials by the Manufacturer and/or Architect shall be corrected at no additional cost to the Owner.

F. Submittals by the Manufacturer shall include the following:
1. Manufacturer's recommended installation instructions and procedures, including written instructions and checklists to be delivered to the Contractor to aid in proper installation of manufacturer's equipment.
2. A schedule indicating tag number, location, and type of all vibration isolators. This shall be sufficiently clear to suffice as a checklist and index for design load, static deflection expected under the design load, specified minimum static deflection, additional deflection to solid under design load, ratio of spring height to spring diameter under design load.
3. Shop drawings of seismic restraints, steel brackets, steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, and vibration isolator and seismic restraint mounting attachment methods.
4. Calculations by a structural engineer licensed in California, certifying that all seismic restraints, bolts, cables and associated components will conform with all applicable code requirements.

5. A list of any contract discrepancies or field conditions which might limit the performance of vibration isolation equipment and components.

G. Submittals by the Contractor (at project completion) shall include the following:
1. A complete tabulation showing for each vibration isolator: (a) the actual static deflection measured at the project and (b) the specified minimum static deflection. Assistance from the vibration isolation equipment Manufacturer may be required.
2. A report certifying a) that each piece of rotating mechanical equipment does not exceed the maximum displacement levels required in this section.

H. Vibration isolation and seismic control equipment shall be provided at all vibration-producing equipment, unless otherwise directed by the Architect.
1. Vibration Isolation and Seismic Control Equipment: Specific vibration isolation and seismic control equipment includes but is not limited to equipment described in this section. Vibration isolation listed in mechanical drawings and schedules shall not supersede this section, unless directed by the Architect.
2. Vibration-Producing Equipment: Vibration-producing equipment includes, but is not limited to, all HVAC equipment with rotating or moving parts, including air handling equipment, condensing equipment, exhaust fans, boilers, pumps, chillers, transformers, dimmer racks, etc.

1.11 VIBRATION CONTROL FOR PIPING SYSTEMS

A. Vibration or noise from plumbing or HVAC piping shall not be transmitted to building structure and components, including, but is not limited to roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.

B. Vibration isolation shall be provided at all active piping systems, unless otherwise directed by the Architect. Specific vibration isolation equipment includes, but is not limited to equipment described in this section, and plumbing drawings and schedules for vibration isolation do not supersede this section.

C. Insure that functional integrity, structural integrity, and manufacturers warrantees for piping systems are not compromised by installation of vibration isolation equipment.

D. Satisfy the requirements of all applicable codes.

1.12 VIBRATION CONTROL FOR TRANSFORMERS

A. Vibration or noise from transformers shall not be transmitted to building structure and components, including, but is not limited to roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.

B. Support transformers on neoprene isolators sized for minimum static deflections of 0.2" under transformer load.

C. All conduit connections to transformers shall be made resilient via sufficient lengths of flexible conduit (with wires pulled) to allow 1" free movement in any direction at mid span.

D. Insure that functional integrity, structural integrity, and manufacturers warrantees for transformers are not compromised by installation of vibration isolation equipment.

E. Satisfy the requirements of all applicable codes.

1.13 VIBRATION CONTROL FOR ELEVATOR EQUIPMENT

A. Vibration or noise from elevator equipment shall not be transmitted to building structure and components, including, but is not limited to roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.

B. Motor/Pump/Tank assemblies shall be mounted on neoprene isolators, in size and number to provide 0.2" minimum vertical static deflection and in accordance with all applicable code requirements. The motor starting relay shall be mounted on the motor/pump/tank assembly.

C. The hydraulic pipe between the tank and the piston base shall be isolated from the building structure by extra thick neoprene pads inserted in pipe saddles.

D. The hydraulic pipe shall be isolated from wall or floors and at penetrations via light duty resilient pipe sleeves.

E. The oil line near the pump shall include an Oil Line Muffler provided by the manufacturer/installer. Oil line Isolation Couplings shall be provided by the manufacturer/installer at connections to both the pump unit and the jack unit.

F. Electrical power and control connections to the isolated elevator equipment shall be made resilient via sufficient lengths of flexible conduit (with wires pulled) to allow 1" free movement in any direction at mid span.

G. Ensure that functional integrity, structural integrity, and manufacturers warrantees for elevator equipment is not compromised by installation of vibration isolation equipment.

H. Satisfy the requirements of all applicable codes. Under no circumstances shall vibration isolation requirements take precedence over code or life safety requirements.

PART 2 – PRODUCTS

2.1 DUCT AND PLENUM LINER

A. The sound absorbing characteristics of duct and plenum lining shall comply with this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has certified test results for proposed products.

B. Submittals shall include octave band absorption coefficients and NRC values for specified thicknesses and densities of lining determined in accordance with the requirements of ASTM C 423 in an F-25 Mounting configuration. Submittals shall also include, but shall not be limited to, a complete description of the tested material and the test conditions, methods, and procedures.

C. All sound absorption measurements and calculations shall be made in complete conformance with the latest revision of ASTM C 423, *Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method,* and ASTM E795, *Standard Practice for Mounting Specimens during Sound Absorption Tests.* Test specimens shall be tested in an F-25 Mounting configuration. Tests shall be conducted by a laboratory that is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) to conduct the test.

D. Duct or plenum lining at specified thicknesses and densities shall have the following minimum octave band sound absorption coefficients when tested in the F-25 Mounting configuration in accordance with ASTM E 795:

	Octave Band Ctr. Frequency in Hertz						
	125	250	500	1000	2000	4000	5000
1"-thick, 2.0pcf:		.15	.50	.55	.80	.85	.95

2"-thick, 2.0pcf	.25	.75	.90	.95	.95	.95

2.3 ACOUSTICAL FLEXIBLE DUCT

A. Flexible insulated round duct, with sound-transparent inner liner constructed of spun-bonded nylon.

B. Must comply with all applicable codes and UL requirements.

2.4 VIBRATION AND SEISMIC CONTROL EQUIPMENT

A. Vibration Isolation and Seismic Control Equipment: Vibration isolation and seismic control equipment shall include but is not limited to the following:
   1. Neoprene Pads (with Appropriate Isolation Washers and Bolts): Minimum 0.1″ deflection "Super W" by Mason or approved equal.
   2. Neoprene Isolator (with Integral Seismic Restraint): Minimum 0.2″ deflection "BR" by Mason or approved equal.
   3. Steel Spring Isolator (with Integral Seismic Restraint): Minimum 2″ deflection "SSLFH" by Mason, "FYS" by Peabody or approved equal. Springs internal to air handling units shall meet the same stability and deflection requirements as provided by SSLFH, FYS, or equal.
   4. Neoprene Isolation Hanger: Minimum 0.2″ deflection "BRD" by A/B, "HD" by Mason, "RH" by Peabody or approved equal.
   5. Steel Spring Isolation Hanger: Minimum 1″ deflection "30" by Mason or approved equal.
   6. Rooftop Spring Curb: Min. 2″ deflection CMAB by Mason or approved equal.
   7. Flexible Pipe Connectors: "MFTNC, MFNEC or MFTFU" by Mason or approved equal.
   8. Flexible Duct Connectors: "KNC-100B" by Peabody or equal.
   9. Flexible Electrical Connection: Flexible conduit installed grossly slack.
   10. Field-Fabricated Resilient/Airtight Sleeve: Oversized sleeve around pipe, conduit, or duct penetration. 1″ clearance all around penetrating element, packed with glass fiber and sealed with at least 1/2″ deep bead of acoustical sealant.

B. Warrantees: All vibration isolation and seismic control equipment shall be warranted against defective workmanship, operation and materials for the life of the equipment supported by these items.

PART 3 – EXECUTION

3.1 NOISE MEASUREMENTS

For all spaces listed in Paragraph 1.2, building system noise measurements shall be made as follows, as part of the project TAB measurement, adjustment, and reporting requirements:

A. Noise levels shall be quantified in all project spaces and compared with the specified maximum allowable Background Noise Criteria (NC) as part of the testing, adjusting and balancing process. Insofar as possible under the jurisdiction of the Air Balance Contractor and the Mechanical Contractor, adjustments shall be made to air-handling equipment to insure that maximum NC are not exceeded in any project space.

B. Submittals shall include the following:

1. Proposed test procedure and measurement equipment before beginning work.

2. Final air balance report, including tabulation of reject space by room number, specified maximum NC, measured NC at each measurement location, octave band sound levels in dB from 63 Hz to 8000 Hz plotted on NC curves at each measurement location, and notes relating to additionally encountered noise sources (other than HVAC).

C. The same Air Balance Contractor shall be responsible for all aspects of air balancing including all sound level measurements. The Air Balance Contractor shall have successful experience in air balancing and sound level measurements including no less than five years experience on projects equal to the size and complexity of this work.

D. Measurement equipment shall be recently-calibrated Type 1 Sound Level Meter with Class II Octave Band Filters and 1/2" random-incidence microphone.

E. The procedure for noise measurements shall be as follows:

1. Sound pressure level measurements shall be made at 5' above floor level in the center of each project space in all octave bands centered between 63 Hz and 8000 Hz, inclusive. Measured levels shall be recorded in decibels (re .0002 microbar) on paper in tabular form and plotted against NC curves for the record. Testing shall be accomplished only during periods when no other trades are working within the building outside noises are at a minimum. Make note of and record on paper all noise sources which cannot be removed, such sources might include electrical, lighting, and plumbing systems.

2. Rebalance or adjust all air-handling equipment causing noise in spaces more than maximum allowable NC. Re-measure sound levels in all such spaces to show compliance with maximum allowable NC. Repeat until noise is minimized to the satisfaction of the Architect, Mechanical Engineer, and Acoustical Consultant.

3.2 VIBRATION ISOLATION SYSTEM ADJUSTMENTS

A. After each equipment unit installation is complete and under full operational load, vibration isolators shall be adjusted so that loads are transferred to them and away from temporary blocking washers and shims. Blocks and shims then shall be removed and used as gauges to judge required clearances. Washers shall be moved away.

B. Inspect all vibration-isolated equipment, coordinate the work of all involved trades, and see that vibration isolators are not short-circuited by seismic restraints, drain lines, conduits, stanchions, control tubing, duct connections, pipe connections, etc. Ensure that hanger isolators and their rods or wires do not touch any other building component.

C. Obtain "rough-in" inspection and approval from the Architect of any installation to be covered or enclosed, prior to such closure.

D. Schedule final inspection(s) by the equipment Manufacturer after installation as needed. Obtain "rough-in" inspection by the Manufacturer of any installation to be covered or enclosed, prior to such closure.

END OF SECTION 01 81 23

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the University's operational needs. This begins in the design phase and continues through construction. The commissioning process incorporates the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing, and training. Commissioning during the construction phase is intended to achieve the following specific objectives:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper functional performance of equipment and systems.
3. Document all non-performing equipment or systems and track corrective actions through to final resolution.
4. Ensure compliance with applicable Title 24, Part 6 requirements
5. Ensure compliance with LEED v4 prerequisite

B. Work includes the completion of formal commissioning procedures on selected equipment and systems, as listed under 1.2 "Related Work" below. Commissioning procedures will be designed and coordinated under the direction of a Commissioning Authority (CA). The Contractor is not responsible for hiring the CA. The CA will work directly for the University. The contractor is responsible for coordinating and cooperating with the CA as necessary to complete the commissioning process.

1.2 RELATED WORK

A. The following sections contain specific information on the systems to be commissioned:

1. Section 230800 HVAC Systems Commissioning.

1.3 DEFINITION OF TERMS

A. Commissioning Authority (CA): is an independent third-party consultant under contract with the University. The Contractor is not responsible for hiring the CA. CA

Responsibilities are listed in this section for information, reference, and clarification. The Commissioning Authority for this project is GAIA Development, Playa Del Rey, California.

B. Commissioning Plan: outlines the commissioning process. Furnish and install a brief overview of each start-up and functional test to be performed and shows the responsible contractor and/or supplier. It also outlines the responsibilities of all personnel to the commissioning process. Estimates the commissioning schedule and furnishes and installs sample Installation Verification, Start-Up, and Functional Performance Test Procedures and related documentation for information

C. Startup Verification Checklist (SVC): The form, filled out by the appropriate sub-contractor, is used to document equipment readiness for startup and functional testing. It includes the on-site inspection and review of related system components for conformance to the specifications. The CA will check for proper systems installation and verify systems readiness for functional testing. Noted deficiencies will be documented and must be satisfactorily resolved prior to continuing with commissioning on the affected component or system.

D. Testing, Adjusting and Balancing: Testing, Adjusting, and Balancing is a process where heating and air conditioning systems are tested against design standards, adjusted for maximum efficiency, and balanced to furnish and install optimum comfort for the occupants. The work typically covers balancing and adjusting air and water distribution in areas of the building served by an HVAC system, and verification and adjustment of heating and cooling loads to insure proper indoor environmental conditions are maintained. Areas that do not meet the engineer's design standards are referred to the appropriate party for correction. Reports are prepared documenting performance and compliance with design standards.

E. Functional Performance Testing (FPT): includes the documented testing of system parameters under actual operating conditions. Final performance commissioning of systems will begin only after the appropriate Contractor certifies that systems are 100% complete, startup test results have been accepted, and the CA agrees that systems are ready for functional testing. The accuracy of installed sensors, gauges, thermometers, etc. is verified. Components are tested in all modes of operation. Systems are tested under various modes, such as during low/high cooling or heating loads, maximum system capacity, component failures, fire alarm, power failure, varying outside air temperature, etc. The systems are operated through all sequences of operation. Components and systems are verified to be operating per the prescribed sequence. Noted deficiencies, items that do not conform to specified requirements, will be documented by the CA for resolution by the Contractor.

F. Commissioning Issues List (Report): generated by the CA, includes deficiencies and issues discovered during the commissioning process. The report also includes the responsible contractor, current disposition of issues, and the date of final resolution as confirmed by the CA. Deficiencies are defined as those issues where products, execution or performance do not satisfy the project specifications, the design intent, or the University's needs.

G. Final Commissioning Report: includes the overall final commissioning document, prepared by the Commissioning Authority, which details the actual commissioning procedures performed, inspection and testing results, and the final version of the deficiencies and resolutions list indicating that all issues discovered through the commissioning process have been verified as resolved.

H. Systems Operations Manual: is an easy to read, plain English guide to the operation and maintenance of the building. It is a supplement to the O&M Manuals providing a "quick look" at the various systems operational sequences, the equipment used to meet the design, and simple maintenance procedures in a "troubleshooting" format.

1.4 COMMISSIONING AUTHORITY'S DUTIES AND RESPONSIBILITIES

A. Meet and communicate with the University's Representatives, contractors, equipment representatives, and design professionals as necessary to facilitate the commissioning process.

B. Write the commissioning plan.

C. Review commissioning related specifications, submittals and construction documents. Communicate noted deficiencies and concerns to the University's Representative.

D. Reviews the School District Owner Project Requirements (OPR) and Basis of Design (BOD) documents to insure the University's intent and design team responses are met.

E. Furnish and install all requirements necessary to attain LEED Energy and Atmosphere Prerequisite: Fundamental Commissioning and Verification
   1. Furnish and install a commissioning team that does not include individuals directly responsible for project design or construction management. The commissioning authority shall report results, findings and recommendations directly to the University.
   2. Review the OPR and the BOD documentation.
   3. Incorporate commissioning requirements into the construction documents.

4. Develop and utilize a commissioning plan.
5. Verify installation and functional performance of commissioned systems.
6. Complete a commissioning report.

F. Develop installation and startup checklists (SVC) from: 1) Information in the specifications, 2) Information from equipment manufacturers as furnished and installed by the contractor, and 3) Information from the design drawings.

G. Coordinate functional testing procedures with appropriate contractors and integrate into the master construction schedule.

H. Develop detailed and specific inspection and functional testing procedures for equipment and systems to be commissioned.

I. Complete a detailed physical inspection and visual checkout of commissioning related equipment and components. Document specific deficiencies for future resolution.

J. Verify equipment and systems start-up procedures as performed by contractors and equipment representatives. Verify appropriate documentation is completed and furnished and installed for inclusion in the final commissioning report. Record deficiencies noted.

K. Schedule and coordinate the final on-site functional testing process. Complete a documented checkout of every specified operating parameter and mode. Document deficiencies and resolutions.

L. Review the contractor furnished and installed Operation & Maintenance manuals. Ensure the manuals furnish and install in-depth, job specific information. Furnish and install formal comment.

M. Verify training of the University's operation and maintenance staff. Review training plan and schedule. Attend training sessions as necessary to ensure high quality, job specific training is furnished and installed in accordance with individual specifications. Work with the University, design team, and appropriate contractors to satisfactorily resolve outstanding issues.

N. Furnish and install the University with final, complete and documented verification to ensure commissioned systems are 100 percent operational per design specifications, prior to the University's acceptance. Exceptions may be made for seasonal commissioning.

O. Perform seasonal commissioning as required to verify proper system operation during peak heating and cooling seasons.

P. Complete all other items noted in individual specifications as Commissioning Authority responsibilities

Q. Furnish and install a final Commissioning Report to the University.

R. Assist in developing a Systems Manual for the project.

1.5 DUTIES AND RESPONSBILITIES OF OTHER FOR COMMISSIONING

A. The commissioning process will require the active participation of persons qualified to represent the following interests: University, Mechanical Engineer, Electrical Engineer, General Contractor, Equipment Manufacturer's Representatives, Mechanical Contractor, HVAC Contractor, Controls Contractor, TAB Contractor, Electrical Contractor, and other specific Subcontractors, as deemed appropriate. The Commissioning Authority will co-ordinate, schedule and oversee the final functional performance commissioning process. Participants shall include in their contracts all costs necessary to participate in and complete the commissioning process. The District is responsible for producing the OPR documentation. A copy of the completed document shall be furnished and installed to the CA prior to plan review and final construction documents.

B. The University's design team (Architects and consultants) is responsible for producing the Basis of Design document that will be referred to throughout the project for commissioning and design related issues. A copy of the completed document shall be furnished and installed to the CA prior to plan review and final construction documents.

C. The Contractor will assure the participation and co-operation of Subcontractors under their jurisdiction, as required for the commissioning process.

D. The University will assure the participation of their chosen representatives.

E. The Architect will assure the participation of necessary representatives from the Design Team. The design team is not normally expected to attend the field-testing, but their participation in commissioning meetings is required. Likewise, their input is needed into the corrective actions taken to remedy deficiencies found during commissioning.

PART 2. PRODUCTS

NOT USED

PART 3. EXECUTION

3.1 PLUMBING, HVAC, AND ELECTRICAL COMMISSIONING

A. See sections 23 00 00, 23 01 30, and 23 05 00for systems to be commissioned. Individual testing proposed for this project is listed at the end of this section under "Testing Summary". Testing will comprise 100% of all devices in the facility.

B. In general, the following equipment and systems require commissioning:
   1. Plumbing Systems
      a. Domestic Water Heating systems
   2. HVAC Systems
      a. Automated Energy Management and Temperature Controls
      b. Terminal Units (Air)
      c. Exhaust Fans
      d. Split System Air Conditioning Units
      e. Testing, Adjusting and Balancing Verification
      f. Interfaces with existing building systems
   3. Electrical Systems
      a. Lighting and lighting controls (sweep or scheduled, daylight, dimming, occupancy sensors)

3.2 SPECIFIC CONTRACTOR RESPONSIBILITIES FOR COMMISSIONING

A. The contractor responsible for completion of the work within his section shall have specific responsibilities relating to demonstrating the equipment and systems furnished and installed have been installed and function per the contract specifications. These responsibilities are as follows:
   1. In order for the commissioning process to go as smoothly as possible and to prevent interruption is the project schedule, the CA will need submittal information early in the project from the contractors in order to compile checklists and procedures for the commissioning team to use. To support this, the contractors shall (for the equipment to be commissioned), submit copies of the manufacturer's installation and startup manuals in digital format (PDF in Optical Character Recognition [OCR]) to the CA prior to installation. Submit other requested equipment documentation to the CA for review.

B. Assist the CA in the development of specific functional performance test procedures relative to their scope of work.

C. Submit written confirmation of system readiness for performance testing to the CA. Schedule the actual date and times for the functional performance testing. Include time for commissioning in the master construction schedule. The schedule should contain the following activities and detail as a minimum.

1. Start Up and SVC verification – expected duration
2. Testing Adjusting and Balancing (as performed by others as specified in Division 1) – begin once associated equipment started, expected duration
3. Functional Performance and Sequence of Operation Testing – expected duration after TAB completes

D. Demonstrate system performance to the Commissioning Authority through completion of the functional performance testing process, per the procedures and acceptance criteria furnished and installed by the CA.

E. Contractors will be responsible for providing qualified representatives/ factory authorized representatives for start-up and testing of equipment to be commissioned. Contractors will be responsible for providing material, equipment and their normal tools, required within the scope of their specialty, to facilitate successfully completing the functional performance testing process. The CA will furnish and install specialized and calibrated test equipment to perform the calibration and functional performance testing. Contractors shall budget and furnish and install sufficient time and qualified personnel to participate on-site in this process until the process is successfully completed and all contractor related deficiencies have been corrected or otherwise resolved. (ie, If during the commissioning process, a valve is found to be inoperable or temperature sensor out of tolerance, the contractor shall furnish and install parts and labor to replace the failed component.)

F. Furnish training to the District. Specified training on related systems and equipment operation and maintenance shall only commence after final performance commissioning is successfully completed, and systems are verified by the Commissioning Authority to be 100% complete and functional. Training is to be conducted by journey or supervisory level technician who is familiar with the equipment installed on this project.

G. The General Contractor will ensure cooperation of his respective subcontractors for off seasonal testing, Near Warranty End Review, and shall ensure the cooperation of

all appropriate sub-contractors in follow-up meetings and any testing, inspections and resolution involving warranty issues prior to the end of the warranty period.

H. A list of warranty issues will be listed on a Near-Warranty-End Issues list by the University and the CA and submit to the contractor. The contractor shall investigate, test and resolve all issues and sign off on each issue and return the list to the CA for back checking prior to the end of the warranty period.

I. The responsible contractor shall reimburse the CA for test failures. After a second failed start-up or functional performance test, the CA and University shall be entitled to additional compensation for time and expenses involved with re-testing. The compensation shall be at published company billing rates.

J. Include a line item for commissioning in the project schedule of values. Ensure sufficient costs are included for the contractor's expenses related to all commissioning tasks.

3.3 ACCEPTANCE CRITERIA

A. Equipment and systems are accepted based on the installation being completed as detailed by the manufacturer and contract specifications. Operational testing is then monitored throughout the Testing, Adjusting, and Balancing activities to confirm operation. The final test is normally during sequence of operation testing for the system of interest.

B. The Commissioning Authority shall not accept systems on behalf of the University's Representatives. The Commissioning Authority may recommend system acceptance to the University upon successful completion of testing in equipment/ systems on the project.

END OF SECTION 01 91 13

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SECTION 02 23 00 - SITE CLEARING

PART 1 - GENERAL

1.1 Description

A. Work included: Clear and grub the site as shown on the Drawings and specified herein. B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
4. Section 02 41 19 Minor Demolition for Remodel

1.2 Quality Assurance

A. A LOR will be retained by the Owner to observe performance of work in connection with Site Clearing, Grading, Excavation and Fill, Utility Trenching, Subgrade and Roadbed preparation, and perform compaction tests.

B. Re-adjust work performed that does not meet technical or design requirements, but make no deviation from the contract documents without specific and written approval from the Architect.

C. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 Product Handling

A. Comply with pertinent provisions of Division 1 of these Specifications for Product Requirements.

PART 2 - PRODUCTS

2.1 Materials

A. Provide materials not specifically described but required for proper completion of the work of this Section as selected by the Contractor subject to the approval of the Architect.

B. Herbicide – Provide a dry, free-flowing, dust-free chemical compound, soluble in water, capable of inhibiting growth of vegetation, and approved for use on this work by
governmental agencies having jurisdiction and the Architect.

PART 3 - EXECUTION

3.1 Surface Conditions

A. A.Verification of conditions:
1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
2. Execution of work under this specification section shall constitute acceptance of existing conditions.
3. Obtain all necessary permits and authorizations by regulatory agencies required to perform the Work under this Section.
4. Verify that utilities have been disconnected and capped before starting selective demolition operations.
5. Record existing conditions by use of Pre-demolition Photographs.
   a. Inventory and record the condition of items to be salvaged and/or re-installed.

B. Correct conditions detrimental to timely and proper execution of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 Protection

A. Protect existing utilities indicated or made known.

B. Protect trees and shrubs, where indicated to remain, by providing a fence around the tree or shrub a sufficient distance away and of sufficient height so trees and shrubs will not be
damaged in any way as part of this
work.

C. Protection of persons and property:
1. Barricade open depressions and holes occurring as part of this work, and post warning lights on property adjacent to or within public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, Lateral movement, undermining, washout, and other hazards created by operations under this Section.

D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to the site at all times.

3.3 Clearing

A. Clearing and Grubbing

1. Remove all surface rocks, debris, trash, tree stumps, roots, and other vegetation within the extent of construction as indicated by the drawings. Do not remove vegetation in other areas.
2. Fell trees, dispose of the trees and other vegetation designated for removal, together with the downed timber, snags, brush, wood, rocks, weeds grass and rubbish. Contractor shall provide a qualified professional tree surgeon to trim individual trees designated to be left standing within the cleared areas of all dead branches and of all live branches to such heights and in such manner as are indicated on the drawings or approved by the Architect. All limbs, branches and roots damaged during construction, together with those required to be trimmed, shall be neatly cut next to the hole of the tree or main branch or root. Cuts more than 1" diameter thus made and any injury to the tree trunk or main branches shall be immediately painted with tree wound paint.
3. Grub soils to a depth adequate to remove all deleterious material from the working area of the site.
4. Refer to drawings for trees and shrubs to be removed. Protect certain trees as indicated.
   a. Remove tops, trunks, and roots of trees and shrubs to a minimum depth of 3 feet or to a depth required to remove all roots.
   b. Chip removed trees, shrubs, and roots.
      1) Removed chipped material to recycling station.
5. Do not leave any root greater than one inch in diameter and larger in the ground to a depth of at least 12" below the existing ground surface or subgrade or the new graded surface, whichever is lower except as specifically approved by the Engineer. Treat roots remaining in the soil with an herbicide approved by the Architect.
6. At building pads, site improvements, or trenching, strip topsoil which contains:
   a. Grass, weeds, and natural vegetation to a minimum depth of 24 inches.
   b. Stumps and roots 1/4 inch and larger.

B. Removal of Debris: Remove all debris from the site in a legal manner and leave the site in a neat and orderly condition subject to the approval of the Owner. Do not store or permit debris to accumulate on the job site.

3.4 Disposal

A. General:
1. Remove brush, grass, roots, trash, and other material from clearing operations.
2. Dispose of away from the site in a legal manner.
3. Do not store or permit debris to accumulate on the job site.
4. Do not burn debris at the site.

3.5 Dust Control

A. At the contractor's expense, use chemical palliative or spread water as required to maintain strict control of dust generated by operation of work under this Section.

3.6 Clean-Up

A. Maintain cleanliness on roadways and other public area used by equipment. Contractor will be held responsible for immediate removal of all spillage on these paving areas. Remove from the Project Site all rubbish, rubble, and debris found thereon and all materials and debris resulting from demolition, leaving site in a safe and clean condition.

END OF SECTION 02 32 00

SECTION 02 41 19 - MINOR DEMOLITION FOR REMODELING

GENERAL SECTION INCLUDES

Removal of designated building equipment and fixtures.

Removal of designated existing construction.

Cap and identify utilities.

Temporary partitions to allow building occupancy.

Schedule of materials and equipment.

Temporary fire protection.

Coordination with hazardous waste removal.

SUBMITTALS

Submit pre-demolition photographs showing conditions of all items to remain that might be misconstrued as damaged by demolition operations. Submit before Work begins.

QUALITY ASSURANCE

Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.4 PROJECT RECORD DOCUMENTS

. Submit record drawings under provisions of Section 01 77 00.

A. Accurately record locations of capped utilities, subsurface obstructions

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable codes for demolition Work, safety of structure, electrical disconnection, reconnection, dust control.

Title 19 CCR, Public Safety, State Fire Marshall Regulations

Comply with Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA, (CCR) Title 24, Part 9, Chapter 33 - Fire Safety During Construction and Demolition..

Obtain required permits from authorities.

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

Do not close or obstruct egress width to exits.

Do not disable or disrupt building fire or life safety systems without 5 days prior written notice to the Owner.

Conform to procedures applicable when hazardous or contaminated materials are discovered.

1.6 SEQUENCING

A. Sequence Work under the provisions of Section 01 32 00.

1.7 SCHEDULING

A. Schedule Work under provisions of Section 01 32 00.

B. Schedule Work to coincide with interior alterations

C. Describe demolition removal procedures and schedule.

1.8 PROJECT CONDITIONS

A. Areas of buildings to be demolished will be evacuated and their use discontinued before start of Work.

B. Owner will occupy building(s) adjacent to demolition area. Conduct demolition so Owner's operation will not be disrupted.

C. Provide at least 72 hours notice to Owner of activities that will affect Owner's operation.

D. Maintain access to existing walkways, exits and other adjacent occupied facilities.

E. Owner assumes no responsibility for areas of buildings to be demolished.

F. Hazardous Materials: It is not anticipated that hazardous materials will be encountered in the Work.
   1. Hazardous materials will removed by Owner before start of Work.
   2. If materials suspected of containing hazardous materials are encountered, do not disturb. Notify Architect.
   3. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.
   4. Hazardous materials will be removed by Owner under separate contract.

PRODUCTS

NOT USED

EXECUTION

3.1 EXAMINATION

A. Correlate existing conditions with requirements indicated.

B. Inventory and record conditions of items to be removed and salvaged.

C. Execute pre-demolition photographs.

D. Verify that hazardous waste remediation is complete.

3.2 PREPARATION

A. Erect and maintain weatherproof closures for exterior openings.

B. Erect and maintain temporary partitions to prevent spread of dust, fumes, noise, and smoke to provide for Owner occupancy.

C. Protect existing items which are not indicated to be altered.

3.3 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent [and occupied] building areas.

B. Cease operations immediately if structure appears to be in danger. Notify Architect. Do not resume operations until directed.

C. Maintain protected egress and access to the Work.

D. Maintain fire safety during demolition in accordance with CFC, Article 87, Section 8706.

3.4 EROSION AND SEDIMENTATION CONTROL

A. Provide erosion and sedimentation control measures in accordance with the requirements of the Storm Water Pollution Prevention Plan.

B. Inspect, repair, and maintain erosion and sedimentation control measures during clearing operations.

3.5 DEMOLITION

A. Disconnect [remove] and cap [and identify] designated utilities within demolition areas.

B. Salvaged Items: Clean, pack, and identify items for storage, protection or delivery to Owner.

C. Demolish in an orderly and careful manner. Protect existing supporting structural members.

D. Except where noted otherwise, remove demolished materials from site. Do not burn or bury materials on site.

E. Remove demolished materials from site as Work progresses. Upon completion of Work, leave areas in clean condition.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Except for items to remain, remove all demolished materials from site and dispose in an EPA approved landfill.

B. Do not burn or bury materials on site.

3.7 SCHEDULES

A. Remove, store and protect the following materials and equipment for reinstallation:
   1. *White boards/ Dry Erase Boards*
   2. *Projectors and Projection Screens*
   2. *TVs and equipment brackets*
   3. *Fire Extinguishers*

B. Remove the following items for the Owner's retention. Contractor shall notify the Owner's Representative if any of the scheduled items are to be removed in the course of demolition and remodeling. Owner will,, within 48 hours, notify Contractor as to which of the above items are to be treated as salvage, and to what location they should be delivered, and shall have the necessary staff and equipment available at that site to unload these items.
   1. Toilets.
   2. Urinals.
   3. Flush valves.
   4. Doors.
   5. Door hardware.
   6. Projectors and Projection Screens
   7. TVs and TV mounting brackets
   8. Air compressors.
   9. Late model central heat units, if not reused
   10. Low voltage components including fire alarm devices and/or communication equipment

C. Protect the following materials and equipment in place:
   1. Finishes
   2. Toilet Partitions
   3. HVAC Ductwork and controls

END OF SECTION 02 41 19

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete footings, foundations and grade beams.

B. Cast-in-place walls.

C. Floors and slabs on grade.

D. Cast-in-place equipment pads.

E. Surface finish of floors and walls.

F. Preparation of concrete base slabs to receive toppings.

1.2 RELATED WORK

A. Section 03 10 00: Concrete Formwork.

B. Section 03 20 00: Concrete Reinforcement.

C. Mechanical and electrical items to be cast in concrete.

1.3 QUALITY ASSURANCE

A. Perform cast-in-place concrete work in accordance with ACI 318, unless specified otherwise in this Section.

B. Inspection and testing will be performed by owner's testing laboratory.

C. Owner's testing agency shall check the first batch at the start of the day to verify materials and proportions conform to the approved mix design.

1.4 SUBMITTALS

A. Submit proposed mix design of each class of concrete to inspection and testing firm and Architect and Engineer for review prior to commencement of work.

B. Three concrete test cylinders will be taken not less than once for every 50 cubic yards of concrete placed or not less than once a day for each class of concrete placed by special inspector.

C. The cement supplier shall submit certification of compliance in accordance with CBC Section 1910A.1.

D. One additional test cylinder will be taken during cold weather concreting and be cured on job site under same conditions as concrete it represents.

E. One slump test will be taken for each set of test cylinders taken.

F. The manufacturer of transit-mix concrete shall deliver to job inspector a certificate with each mixer truck. Certificate shall bear signature of representative of Testing Laboratory, stating quantity of cement, fine aggregate, coarse aggregate, and admixtures contained in load. Certificates shall indicate time, to the nearest minute, that batch was mixed.

1.5 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 318 - Building Code Requirements for Reinforced Concrete
2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing concrete.
3. ACI 301 - Specifications for Structural Concrete for Buildings.
4. ACI 305 - Hot Weather Concreting.
5. ACI 306 - Cold Weather Concreting.

B. All work shall be done in accordance with California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: Portland, Type II; ASTM C150. Gray, except where noted, supplement with the following:

1. Fly Ash: 25 percent maximum; Fly Ash shall conform to ASTM C618 Class N or F.
2. Combined Fly Ash and Pozzolan: 19 percent maximum
3. Ground Granulated Blast Furnace Slag: 50 percent maximum
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent maximum with combined Fly Ash and Pozzolans not exceeding 25 percent

B. Fine and Coarse Aggregates: ASTM C33 for normal weight concrete. Aggregate shall be from established sources with proven history of successful use in producing concrete with minimum shrinkage. The average drying shrinkage after 28 days shall not exceed 0.045 percent for hardrock concrete.

C. Water: Clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

D. Source of aggregate shall remain constant for the duration of the work, as practical.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.1 percent chloride ions.

C. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and containing not more than 0.1 percent chloride ions.

D. Pozzolan: ASTM A618, containing not more than 0.1 percent chloride ions.

E. Calcium Chloride: Not permitted.

F. ASTM C 494, Type C, 30% + 2% solution of Calcium Nitrite

2.3 ACCESSORIES

A. Bonding Agent: "Anvil Bond" as manufactured by Master Builders or approved equal.

B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2400 psi in two days and 6000 psi in 28 days.

C. Absorptive Mats: Cotton fabric or burlap-polyethylene, minimum 8oz./sq. yd; bonded to prevent separation during handling, placement and curing.

D. Liquid Membrane-Forming curing Compound: Conforming to ASTM C309, Type I, and which will not discolor concrete or affect bonding or other finish applied thereover, and which restricts loss of water to not more than 0.500 grams per sq. cm. of surface when tested per ASTM C156.

E. Provide Fly Ash or other reclaimed cementitious materials as indicated in Section 2.01.A.

F. Slab-Leveling Compound. Provide leveling compound where required to meet floor flatness and levelness requirements. Acceptable products include Ardex SD-L, Burke 300 Durock or approved equal.

2.4 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used,

use an independent testing facility acceptable to Engineer and Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Except as otherwise specified, submit written reports to Architect and Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect and Engineer.

C. Unless lower limits are stated in the contract documents, all concrete exposed to freezing and thawing in moist condition and/or required to be watertight or used in slabs-on-grade shall have a maximum W/cm ratio of 0.45.

D. Provide concrete of following strength:

1. Compressive strength (28 day) shall be as shown on Structural Drawings.
2. Select proportions for normal weight concrete in accordance with ACI 301 by Method 1, 2 or 3 as applicable. Add air-entraining agent to concrete to entrain air as indicated in ACI 301.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, water, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by architect before using in work.

F. Admixtures:

1. Use water-reducing admixture or high-range, water-reducing admixture (super plasticizer), may be used in concrete subject to approval by Architect.
2. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F (10 degrees C).
3. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content of 4 percent to 6 percent.

2.5 CONCRETE MIXES

A. Ready-Mix Concrete: All concrete shall be ready-mix concrete unless otherwise approved by the Engineer and Architect.

B. Self-Leveling Concrete Topping - Underlayment for Interior Applications:

1. Topping for epoxy terrazzo flooring application shall include latex modifier, such as “TERA-GEM III, Revocoat Latex #1 Additive”. Follow manufacturer’s recommendations and flooring installation requirements.

2. Use self-leveling underlayment concrete formulated to level concrete floors without shrinking, cracking or spalling, and capable of being placed from feathered edge to 1" thickness without aggregate in one pour. If greater than 1" thickness is required, aggregate shall be used in accordance with manufacturer's requirements. Appropriate primer shall be utilized for all underlayment applications.
3. Example acceptable product: Ardex Engineered Cements "ARDEX K-15"
4. Example acceptable product: Euclid Chemical's "Flo-Top or Super Flo-Top"
5. Example acceptable product: Sika Corporation "Sika Level Series"
6. Example acceptable product: BASF "MasterTop 110SL"

PART 3 - EXECUTION

3.1 PLACING CONCRETE

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Place concrete in accordance with ACI 304, and as herein specified.

C. Notify Structural Engineer minimum 48 hours prior to placing of concrete.

D. Ensure anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause problems in placing concrete. Rectify misplacements and proceed with work.

E. Maintain records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

F. Ensure reinforcement, embedded parts, formed expansion and contraction joints, and other inserts are not disturbed during concrete placement.

G. Prepare previously placed concrete by blowing joints and provide keyway.

H. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified only with prior approval of the Architect. Deposit concrete as nearly as practicable to this final location to avoid aggregation.

I. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

J. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand- spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

K. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

L. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

M. Bring slab surfaces to correct level with straight-edge and strike off. Use bull floats or derbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

N. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer and Architect immediately on discovery.

O. Conform to ACI 305 when concreting during hot weather.

P. Conform to ACI 306 when concreting during cold weather.

Q. Unless otherwise permitted, time for completion of discharge shall comply with ASTM C94/C94M. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, verify that air content of air-entrained concrete, slump, and temperature of concrete are as specified. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, no water may be added.

3.2 FINISH OF FORMED SURFACES

A. Rough Form Finish: For all formed concrete surfaces except as noted below. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projects exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaced exposed-to-view or to be covered with a material such as waterproofing that requires a smooth surface. This is as cast arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas, with fins or other projects completely removed and smoothed.

3.3 MONOLITHIC SLAB FINISHES

A. General: finish slab surfaces in accordance with one of the finishes noted below, as designated in the Contract Documents. Finish all joints and edges with proper tools as approved.

B. Placement: Place concrete at rate that allows spreading, straight-edging, and darbying or bull floating before bleed water appears. Screed all slabs, topping fills to true levels and slopes. Work surfaces as required to produce specified finish. Do no finishing in areas where water has accumulated; drain and re-screed. In no case use a sprinkling of cement and sand to absorb moisture.

C. Tolerances: Measure slabs-on-grade to verify compliance with the tolerance requirements of ASTM E 1155 and ACI 117. Measure floor finish tolerances within 72 hours after slab finishing and before removed of supporting formwork or shoring.

1. Concrete slab flatness and levelness tolerances to meet ACI 117, Section 4.5.6.a. Minimum requirements at slab-on-ground: Flatness overall min Ff = 20 and levelness overall min Fl = 17.

D. Scratch Finish:

1. Apply scratch finish to monolithic slab surfaces that are to receive mortar setting beds for tile, where mortar set tile is indicated on drawings.
2. After placing slabs, plane surface to a tolerance not exceeding ¼" in 10' when tested with a 10' straightedge. Slop surfaces uniformly to drains where required. After leveling, roughen surface before final set, with staff brushes, brooms, or rakes.

E. Float Finish:

1. Apply float finish to monolithic slab surfaces scheduled to receive trowel finish and other finishes as hereinafter specified.
2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surfaces to a uniform, smooth, granular texture.

F. Trowel Finish:

1. Unless otherwise noted, apply trowel finish to monolithic slab surfaces to be left exposed-to-view, or scheduled to receive floor finishes other than setting bed types.

2. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding those called out above in section C. Grind smooth surface defects, which would telegraph through applied floor covering system.

G. Non-Slip Broom Finish:

1. Apply non-slip broom finish to exterior concrete platforms, walkways, steps and ramps, and elsewhere as indicated.
2. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.4 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start curing procedures as soon as free water has disappeared from concrete surface after placing and finishing.
2. Continue curing as directed by Architect and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by either moist curing, by moisture retaining cover curing, membrane curing, or by combinations thereof, as herein specified.

1. Provide moisture curing by following methods:
   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed at widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide liquid membrane curing as follows:
   a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as possible after final finishing operations are complete, but not later than 2 hours. Apply uniformly in a continuous operation by power spray equipment or roller equipment in accordance

with the manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

b. Verify compatibility of membrane curing compounds on surfaces that are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings, and finish materials, unless otherwise acceptable to the Architect.

c. Do not use curing compounds that will diminish bond of subsequent materials.

4. Curing Formed surfaces: Cure formed concrete surfaces, including walls with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
5. Curing Unformed surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by any of the methods specified herein, as applicable.

3.5 PATCHING

A. Allow Architect/Structural Engineer to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as directed.

3.6 FIELD QUALITY CONTROL

A. Contractors Testing Laboratory: As specified in section 1.3 of this specification.

3.7 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required lines, details, and elevations.
B. Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects. Patch, fill, touch up, repair, or replace exposed architectural concrete for each individual area in accordance with Architect's particular directions.

END OF SECTION 03 30 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes: Provision of all lumber framing, rough hardware, blocking and backing as indicated in the contract drawings.

1.2 REFERENCES

A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.

B. The following published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section (latest editions apply).

1. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).

2. (APA) - American Plywood Association, "Guide to Plywood Grades."

3. (PS) - United States Product Standard, PS-1 and PS-2 "Construction and Industrial Plywood."

4. (UL) - Underwriters' Laboratories, Inc., "Fire Hazard Classification, FR-S."

5. (WCLIB) - West Coast Lumber Inspection Bureau, "Standard Grading Rules No. 17."

6. (WWPA) - Western Wood Products Association, "Grading Rules for Lumber."

7. (AWPA) - American Wood Preservers Association Standards.

a. T1 – "Processing and Treatment Standard"

b. U1 – "User Specification for Treated Wood"

8. (AF&PA) - American Forest and Paper Association, "National Design Specification for Wood Construction." "Special Design Provisions for Wood & Seismic.".

9. (ASTM) - American Society of Testing and Materials.

1.3 SUBMITTALS

A. Shop Drawings of all specially fabricated rough hardware.

B. Certification: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mil.

C. Samples as requested by the architect.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.

B. Keep materials under cover and dry. Protect against exposure to moisture and contact with damp or wet surfaces. Where necessary, stack materials off ground on level flat forms, fully protected from weather.

1.5 JOB CONDITIONS

A. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19-percent during and after installation.

B. New lumber adjacent and connected to existing lumber shall have a moisture content of not more than 15 percent at the time of installation.

C. Sequencing, Scheduling: Coordinate details with other Work supporting, adjoining or fastening to rough carpentry Work.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Rough Carpentry:

1. Sills on Concrete: Douglas Fir with Preservative Treatment.

2. Lumber (Wood Framing): Meet requirements of following minimum grades.

Item	
Studs	D.F. No. 1
Plates	D.F. No. 1
Beams	D.F. No. 1
Joists	D.F. No. 1
Batten	D.F. No. 1
Posts	D.F. No. 1
Blocking	D.F. No. 2

3. Plywood: Provide thickness, grade, and panel identification index shown on drawings. For plywood thickness 15/32 or greater provide a minimum of 5 ply.

B. Rough Hardware: All exterior hardware shall be hot-dipped galvanized.

1. Nails: Common wire per ASTM F1667, typical; hot-dipped zinc-coated galvanized, stainless steel, silicon bronze, or copper at exposed conditions, fire-retardant-treated, and preservative-treated lumber.

2. Expansion Bolts: Reverse cone, self-wedging, expansion type, Tightening of nut or increased tension on bolt shank shall act to force wedges outward to create positive increased resistance to withdrawal, Simpson Strong-Bolt 2, Hilti Kwik-Bolt TZ2, or equal product substituted per Section 01 63 00.

3. Metal Framing Connectors: Fabricate from hot-dipped galvanized steel (G90 coating). Connectors in contact with preservative-treated lumber shall have G185 hot dipped galvanized coating per ASTM A653. Connectors in contact with fire-treated lumber or are in high corrosive environments shall be manufactured with Type 316L stainless steel. Connectors shall be at least 16-gauge material, 1/8-inch plate materials where welded, unless otherwise shown or specified, punched for nailing. Nails and nailing shall conform to the manufacturer's instructions, including coating and material where applicable, with a nail provided for each punched nail hole. Use maximum nail size listed by manufacturer. Manufactured by Simpson Company or equal product substituted per Section 01 60 00.

4. Miscellaneous Hardware: Provide all common screws, bolts, fastenings, washers and nuts required to complete rough carpentry Work.

5. Bolts and sill bolts in wood shall be ASTM A307 with standard cut threads; full diameter bolts (no rolled or "upset" threads permitted) per ANSI/ASME standard B18.2.1.

6. Fasteners used for attachment of exterior wall coverings shall be hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze, or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc-coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.

2.2 TREATMENTS

A. Fire-Retardant Treatment: Furnish in accordance with AWPA Standards T1, U1, and P17, "Fire Retardant Formulations."

B. Preservative Treatment: Furnish in accordance with AWPA Standards T1 and U1. Preservatives with an ammonia base, including Ammoniacal Copper Zinc Arsenate (ACZA) are not permitted.

2.3 FABRICATION

A. Preparation:

1. Verify measurements at job site.

2. Verify details and dimensions of equipment and fixtures integral with finish carpentry for proper fit and accurate alignment.

3. Coordinate details with other work supporting, adjoining, or fastening to casework.

B. Lumber:

1. Air- or kiln-dry to maximum 19-percent moisture content at time of surfacing.

2. Furnish surfaced four sides, S4S, unless otherwise noted.

3. Size to conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.

C. Wood Treatments:

1. Fire-Retardant Treatment:

a. Treat in accordance with AWPA Standards T1 and U1 and approved manufacturer's recommendations. Verify AWPA Use Category with proposed application prior to selected preservative. Fire treated lumber shall conform to the requirements of CBC Section 2303.2.

2. Preservative Treatment:

a. Treat lumber and plywood sheathing that is:

i. In contact with concrete and masonry less than six feet above the ground.

ii. Exposed to weather permanently.

iii. Where specified in the Contract Documents.

b. Treat in accordance with AWPA Standards T1 and U1. Verify AWPA Use Category with proposed application prior to selecting preservative.

c. Treated lumber shall be marked per CBC Section 2303.1.9.1.

d. After Treatment and prior to shipping, air- or kiln-dry lumber to maximum 19-percent moisture content.

2.4 SOURCE QUALITY CONTROL

A. Lumber shall bear grade-trademark or be accompanied by certificate of compliance of appropriate grading agency.

B. Plywood shall bear APA grade-trademark.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive rough carpentry Work and verify following:

1. Completion of installation of building components to receive rough carpentry Work.

2. That surfaces are satisfactory to receive Work.

3. That spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailers.

4. That all anchor bolts and holdown bolts are properly installed.

3.2 INSTALLATION

A. Cutting: Perform all cutting, boring, and similar Work required.

B. Selection of lumber pieces:

1. Carefully select all members. Select individual pieces so that knots and defects will not interfere with placement of bolts, with nailing or making connections.

2. Cut-out and discard pieces with defects that make the piece unable to serve its intended function. The Architect may reject lumber, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus or mold as well as for improper cutting or fitting.

3. Shimming: Do not shim sills, joists, short studs, trimmers, headers, lintels and other framing members unless specifically detailed in drawings.

C. Drill holes in pieces where splitting may occur.

1. Remove split lumber and replace with new members.

2. Fasten framing anchors and steel bridging with galvanized special nails furnished with hardware in every nail hole, except where noted to be welded to structural steel supports in which case comply with AWS requirements.

D. Studs, Joists, Beams, and Posts: Install all members true to line. No wood shingle shims are permitted. Place joists with crown up; maximum 1/4-inch crown permitted.

E. Nail joints in accordance with applicable requirements of the CBC Table 2304.10.2 unless otherwise shown or specified. Predrill where nails tend to split wood. Nails into preservative-treated lumber shall be hot-dipped galvanized.

F. Bolt holes to be 1/16-inch oversize. Threads shall not bear on wood. Use standard malleable iron washers against wood. Carriage bolts require washers under the nut only.

G. Provide blocking, grounds, nailers, stripping, and backing as shown and as required to secure other Work.

H. Adjoining sheathing panel edges shall bear and be attached to the framing members. Nails shall be placed not less than 3/8-inch from the panel edge.

I. Plywood flooring shall be field glued with adhesive meeting APA specification AFG-01 applied in accordance with the manufacturer's recommendations. Apply continuous line of glue on joists and in groove of tongue and groove panels.

J. Protect preservative-treated and fire-treated lumber per APWA Standard M4, "Standard for the Care of Preservative-Treated Wood Products."

K. Where wood is cut, sawed, planed, bored or marred after preservative or fire-retardant treatment, apply two heavy brush coats of same material used in treatment.

L. Nail heads shall be driven flush with plywood surface. Overdriven nails (nails which fracture the outer ply layer) shall be replaced one for one.

M. Screws (Wood or Lag): Screws shall be screwed and not driven into place. Screw holes for the unthreaded portion shall be predrilled to the same diameter and depth of shank. Holes for threaded portion shall be predrilled less than or equal to the diameter of the root of the thread. Provide standard cut washers under head of lag screws.

N. Sheathing used for diaphragms and shear walls that are part of the seismic-force-resisting system shall be applied directly to framing members.

3.3 CLEANING AND ADJUSTING EXPOSED TIMBER

A. Remove damaged or otherwise disfigured portions and replace with new prior to the Owner's acceptance.

B. Wash finished Work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed surfaces. Any difference will be considered unsatisfactory work.

3.4 FIELD QUALITY CONTROL

A. The Owner's Testing Agency shall:

1. Inspect erected timber framing as required to establish conformity of work with Drawings.

2. Inspect all timber connectors per CBC Section 1705A.5.6.

B. Machine Nailing: Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and the approval of the Project Inspector and the Structural Engineer. The approval is subject to continued satisfactory performance. If the nail heads penetrate the outer ply more than would be normal for a hand-held hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory and machine nailing shall be discontinued.

3.5 CLEAN-UP

A. Dispose of pressure-treated wood in an authorized disposal area. DO NOT BURN TREATED WOOD. Do not bury wood of any type on the jobsite.

END OF SECTION 06 10 00

SECTION 06 41 00 - INTERIOR ARCHITECTURAL LAMINATED CASEWORK

PART 1 - GENERAL

1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. SUMMARY

A. This Section includes the following:
   1. Plastic-laminate countertops. (PL-1)
   2. Plastic-laminate cabinets (PL-2).

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
   2. Division 10 Section “Visual Display Surfaces” for marker board incorporated in custom teaching wall.

3. DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

4. SYSTEM DESCRIPTION

A. Design Requirements:
   1. Cabinet Grade(s):Comply with Architectural Woodwork Standards 2nd Edition (2014)
      a. Custom Grade cabinets (classrooms)
      b. Premium Grade cabinets (reception areas)
   2. Cabinet Types:
      a. Frameless
         1. Flush overlay
         2. Reveal Overlay
         3. Lipped

b. Face Frame
    1. Flush overlay
    2. Reveal Overlay
    3. Lipped

3. Cabinet and Drawer Hardware:
    a. Provide touch latches and/or U-shaped wire pulls at all accessible casework or equally accessible pull hardware.

5. SUBMITTALS

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

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
    1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
    2. Apply WI-certified compliance label to first page of Shop Drawings and follow Section 1, "Guidelines for Architectural Millwork Shop Drawing".

C. Samples for Initial Selection: For each type of product indicated requiring product selection.

D. Samples for Verification:
    1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
    2. Exposed cabinet hardware and accessories, one unit for each type and finish.
        a. Hardware samples will be returned up on approval.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates for Product and Installation: WI-certified compliance certificates confirming conformance with Certified Compliance Program (CCP).

G. Qualification Data: For Installer and fabricator.

6. QUALITY ASSURANCE

A. Reference Standards:
    1. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
    2. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA

3. Title 24 CCR, Part 6 - 2022 California Energy Code
4. Title 24 CCR. Part 8 - 2022 California Historical Building Code
5. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2021 IFC, as Amended by CA
6. Title 24 CCR, Part 10 – 2022 California Existing Building Code
7. Title 24 CCR, Part 12 - 2022 California Reference Standards Title 19 C.C.R., Public Safety, SFM Regulations.
8. Americans with Disabilities Act (ADA), Title II or Title III.
9. Architectural Woodwork Standards (Edition 3.1-2017)

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

C. Installer Qualifications: Licensee of WI's Certified Compliance Program.

D. Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
   1. Before delivery to job-site, Millwork supplier:
      a. Licensees of WI shall issue a certified compliance certificate indicating millwork products being furnished for this project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
      b. Non-Licensees of WI shall provide evidence that they have arranged for inspection by WI inspector after completion of fabrication and installation. If conditions are found to be compliant, inspector will issue Compliance Certificate indicating millwork products being furnished for this project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
   2. Each elevation of casework and each countertop shall bear certified compliance label.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

7. DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

8. PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

9. COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

10. WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of interior architectural woodwork that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

1. MANUFACTURERS

A. Acceptable Manufacturers:
   1. Active member of the Woodwork Institute licensed by WI to provide WI Certified Compliance Certificates and Labels for the products and materials specified in this Section.

B. High-Pressure Decorative Laminate: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
   1. Wilsonart International; Div. of Premark International, Inc. (Basis of Design)
   2. Formica Corporation.
   3. Nevamar Company, LLC; Decorative Products Div.
   4. Or equal (Reference substitution requirements in Section 01 60 00).

C. PLASTIC-LAMINATE COUNTERTOPS
   1. High-Pressure Decorative Laminate Grade: HGS, 0.048 inches (1.2 mm) thick.
   2. Provide Exterior grade plywood at wet locations and comply with following:
   3. No seams shall occur within 18 inches of sink cut-outs.
   4. Sink cut-outs shall be coated with opaque sealer.
   5. Back splash shall coordinate with size of soap and paper tower dispensers for solid attachment.
   6. Corners of tops shall be cut at 45 degrees if projecting or in pathway.
   7. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   8. Colors: per architect's selection from full range of standard colors
      a. Countertops (laminate or solid surface)
   9. Edge Treatment: Self-edge banded or as detailed.
   10. Medium-density fiber board (MDF). Do not use plywood.
   11. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

C. Solid Surface Counter-tops: Corian® surfaces from the DuPont company (Basis of Design).
or equal (Reference substitution requirements in Section 01 60 00).
1. Thickness:
a. 1/2″
2. Edge Treatment
a. Radius 1/4 inch with drip groove.
3. Color:
a. As selected from full range of manufacturers colors

D. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
1. Medex, Medex NC, Medite II, or Arreis SDF by SierraPine Ltd.
2. Weyerhaeuser Company; Premier Plus by Weyerhaeuser.
3. Or equal (Reference substitution requirements in Section 01 60 00).

2. CABINET HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified and as modified below

B. Cabinet hardware: Subject to compliance with requirements, provide products by one of the following manufacturers if not listed under the specific component
1. Accuride.
2. Blum
3. Hafele.
4. Or equal (Reference substitution requirements in Section 01 60 00).

C. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

D. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
1. Provide a Schedule for the cabinet locks installed.
2. Schedule to conform to BHMA A156.9 and include the following information:
a. Building that they are installed in.
b. Room number use Districts (sign) Room Numbers) where lock is installed in.
c. Manufacturer.
d. Model number of cylinder used.

3. Format of Schedule: Excel.

F. Catches: Magnetic.

G. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: As required by WI standards.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.
6. Products:
a. Accuride International, Inc: www.accuride.com.
b. Grass America Inc: www.grassusa.com.
c. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.

H. Hinges: European style concealed self-closing type, BHMA No. grade 1, steel with polished finish.
1. Provide hinges with provision for attachment to all-glass doors where indicated.

3. MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Core and Substrates: Comply with the following:
1. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.

D. High-Pressure Decorative Laminate (HPDL): NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

E. Solid Polymer Components:
1. Cast. Non-porous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.

4. CABINET HARDWARE AND ACCESSORIES

A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

B. Grommets: Plastic, 2 inch diameter, locations as indicated. If locations are not indicated, as selected by Architect during shop drawing review. Doug Mockett, Sugatsune, Wood Technology, or equal.

C. Drawer and Door Pulls: For all, including accessible casework.
1. "U" shaped wire pull, aluminum with satin finish, 4 inch centers.

D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish to key with door hardware. All doors and drawers to be lockable.

E. Hinges: Concealed (fully mortised) self-closing type, BHMA No. 652, steel with polished finish.
1. Products: Blum or equal.

F. Drawer Slides: BHMA A156.9, B05091.
1. Heavy Duty (Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides. Model 3640 by Accuride or equal.

5. MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

6. FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
2. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect 7 days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
1. Seal edges of openings in countertops with a coat of varnish.

7. PLASTIC-LAMINATE CABINETS

A. WI Construction Style: Style A, Frameless. Or Face Frame

B. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

C. WI Door and Drawer Front Style:

1. Flush Reveal overlay.
2. Flush overlay
3. Lipped

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Both sides of all shelves shall be 0.028 high pressure decorative laminate, regardless of location or exposure, and shall not span more than 34 inches.
   2. Shelves shall be retained with seismic clips.
   3. Cabinets shall be designed for full use of corners.
   4. Upper cabinets shall be at 4'-6" AFF max.

E. Semi-Exposed Surfaces: Any one of following.
   1. Low pressure decorative polyester overlay.
   2. Low pressure decorative melamine overlay.
   3. HPL cabinet liner.
   4. Solid Phenolic core (SPC).

F. Concealed Surfaces: Any of one of following.
   1. Solid Wood or Plywood: Any hardwood or softwood species, with no defects affecting strength or utility. Hardwood and softwood lumber kiln dried to 7 and 10 percent moisture content, respectively.
   2. Particleboard: ANSI A208.1, Grade M-2.
   3. Medium-Density Fiberboard: ANSI A208.2.
   4. Solid Phenolic core (SPC).

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. Colors: per Architects selection from full range of standard colors

8. PLASTIC-LAMINATE COUNTERTOPS

A. High-Pressure Decorative Laminate Grade: HGS, 0.048 inches (1.2 mm) thick.

B. Provide Exterior grade plywood at wet locations and comply with following:
   1. No seams shall occur within 18 inches of sink cut-outs.
   2. Sink cut-outs shall be coated with opaque sealer.
   3. Back splash shall coordinate with size of soap and paper tower dispensers for solid attachment.
   4. Corners of tops shall be cut at 45 degrees if projecting or in pathway.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Colors: per Architects selection from full range of standard colors
2. Edge Treatment: Self-edge banded for laminated OR For Solid Top ¼" Radiused corners

D. Laminate Substrates: Medium-density fiber board (MDF). Do not use plywood.

E. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

PART 3 - EXECUTION

1. PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

2. INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

H. Refer to Division 9 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3. ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 41 00

SECTION 07 21 16 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Batt insulation and vapor barrier in exterior wall and roof construction.

B. Batt insulation for filling perimeter window and door shim spaces. crevices in exterior wall and roof.

C. Batt sound insulation in interior walls and partitions and above ceiling.

1.2 QUALITY CONTROL

A. Reference Standards:
1 Title 19 CCR, Public Safety, State Fire Marshall Regulations
2 Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
3 Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2018 IBC, as Amended by CA
4 Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
5 Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
6 Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)
7 Title 24 CCR, Part 6 - 2022 California Energy Code
8 Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
9 Title 24 CCR, Part 10 - 2022 California Existing Building Code
10 Title 24 CCR, Part 12 - 2022 California Reference Standards.
11 Americans with Disabilities Act (ADA), Title II or Title III.

B. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C. ASTM C1320 - Installation of Mineral Fiber Batt and Thermal Insulation for Light Frame Construction.

D. ASTM C 578: Standard Specification for Rigid Cellular Polystyrene Thermal Insulation

E. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

F. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

G. International Code Council Evaluation Service (ICC-ES), Evaluation Report.

H. CCR - California Code of Regulations.

I. CBC - California Building Code.

1.3 PERFORMANCE REQUIREMENTS

A. Materials of this Section shall provide continuity of thermal and moisture barrier at building enclosure elements.

B. Materials of this Section shall provide continuity of sound control where indicated or scheduled.

1.4 REGULATORY REQUIREMENTS

A. Installation of insulation may only commence if insulation meets mandatory manufacturer certification to the California Energy Commission required by Title 24, Part 6, Section 118 of the California Code of Regulations (CCR) that insulation complies with Title 20, Chapter 4, Article 3 of the California Quality Standards for Insulating Materials.

B. Insulation materials shall be certified in compliance with Business and Professions Code Section 19165.

C. Insulation manufacturer shall be licensed by the California Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation according to Business and Professions Code, Section 19059.7.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Product Data for each type of insulation specified.

C. Submit manufacturer’s certification that materials meet or exceed specified regulatory requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original packaging.
B. Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.
1 In the event the board insulation becomes wet, wipe dry prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

A. Certain Teed Corp.

B. Manville Corp.

C. Owens-Corning Fiberglass Corporation.

2.2 MATERIALS

A. Batt Insulation: ASTM C665 preformed glass fiber batt, Type III, Class A, Category 1 with stapling flanges for attachment of blanket to applicable construction. Equivalent continuous roll membrane facing may be utilized in lieu of individual faced glass fiber batts. Provide R30 at ceilings and roofs, R19 at walls.

B. Batt Sound Insulation: ASTM C665 preformed glass fiber batt, Type I unfaced, with flame spread of 25 or less, and a smoke density of less than 450 when tested in accordance with UL 723-03. Provide R-15, 3½ inch minimum thickness.

D. Nails or Staples: Steel wire; electroplated; type and size to suit application.

E. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inches wide.

F. Support Wire: 16 gauge steel wire.

G. Support Rods: 13 gauge, pointed spring steel length as required for stud spacing.

H. Spindle Fasteners: Steel impale spindle and clip on flat metal base, [spot welded to substrate] [self adhering backing], length to suit insulation thickness, capable

of securely and rigidly fastening insulation in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

B. Do not install until building is fully enclosed to weather.

3.2 INSTALLATION

A. Install insulation in accordance with insulation manufacturer's instructions and ASTM C739, C1149 and C1320. Cut “blow-in” holes only where specifically needed.

B. Install batt insulation in exterior walls, ceiling furring, and roof spaces without gaps or voids. Where wood framed furred ceiling occur, install insulation over the furring strips rather than between the rafters.

C. Install batt sound insulation in interior walls and where indicated or scheduled.

D. Install blow-in insulation in cavities where it is unfeasible to install batt insulation.

E. Trim insulation neatly to fit spaces.

F. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

G. Install with factory-applied membrane facing on warm side of building spaces.

H. Lap ends and side flanges of vapor barrier membrane over face of framing members.

I. Extend vapor barrier on to any adjacent construction and tape seal edge of vapor barrier.

J. Seal butt ends, lapped flanges, and tears or cuts in membrane with tape or another layer of membrane.

K. Seal joints in vapor barrier caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier.

L. [Face staple flange over flange of adjacent blanket to wood studs at maximum 6 inches on center.]

M. [Tape stapling flange over flange of adjacent blanket to flange of metal stud.]

N. Friction fit sound insulation between studs as required to completely fill space between the wall finishes.

O. Where wall finish does not occur, [use support rods spaced not more than 16 inches on center vertically at wood studs.] [use 16-gauge support wire through studs at not more than 16 inches on center vertically at metal studs.]

P. Retain unsupported roof insulation to metal or concrete substrate with spindle fasteners at 24 inches on center.

Q. Coordinate patching of “blow-in” holes with Work under other Sections.

R. Remove all unused insulation and related products and dispose of correctly.

END OF SECTION 07 21 16

SECTION 07 25 00 - WEATHER BARRIER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

B. Flexible flashings at openings in Air Barriers and parapets.

1.2 RELATED REQUIREMENTS

A. See Division 01

1.3 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.4 REFERENCE STANDARDS

A. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007.

1.5 ADMINISTRATIVE REQUIREMENTS

A. A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include but not be limited to the following:
   1. Review of submittals.

2. Review of surface preparation, minimum curing period and installation procedures.
3. Review of special details and flashings.
4. Sequence of construction, responsibilities and schedule for Subsequent operations.
5. Review of mock-up requirements.
6. Review of inspection, testing, protection and repair procedures.

1.6 SUBMITTALS

A. Product Data: Provide data on material characteristics, performance criteria, and limitations.

B. Samples: Submit 12-inch square fabrication sample of specified materials and wall flashing.

C. Shop Drawings: Provide drawings of special joint conditions, standard installation details and details showing interface with adjacent materials at terminations to demonstrate a complete barrier.

D. Applicator to submit a minimum of three successful installations in the last three years of similar size, substrate and materials.

E. Manufacturer's Installation Instructions: Indicate required preparation.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain materials, components and accessories used for the Project through one source from a single manufacturer. Sustainable Design Requirements:
   1. Description: UV-resistant, single-component, vapor permeable, fluid applied air barrier membrane. Products must conform to BAAQMD VOC limits.

B. Applicator Qualifications:
   1. Company specializing in installation of air barriers with minimum three years experience and certified by air barrier manufacturer. Provide project list and contacts for verification.
      OR
   2. Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance with the ABAA Quality Assurance Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Protect fluid-applied membrane components from freezing and extreme heat.

D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.9 PROJECTION CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive the air barrier.

1.10 WARRANTY

A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.
   1. Failures include, but are not limited to, the following:
      a. Failure to maintain air permeance rating not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 pst) (equal to 0.02 Us. x sq. m. @ 75 Pa), when tested per ASTM E2178, within specified warranty period.
      b. Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ASTM E96, Method B.
      c. Warranty Period: Five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Coating: Cold-fluid-applied, vapor permeable, elastomeric waterproofing membrane.

1. Material: Water-based acrylic or polymer-modified bitumen, with VOC content of zero.
2. Products:
    a. Perm-A-Barrier VP (Basis of Design) by Grace Building Products, www.gracebuildingproducts.com.
    b. Acceptable Manufacturers:
        1) AirBlock 33 by Henry Company, www.henry.com.
        2) ExoAir 220 Fluid-Applied Vapor Permeable Air Barrier Membrane" by Tremco, Inc., wwwtremcosealants.com.
        3) Or equal (Reference substitution requirements in Section 01 60 00)

2.2 FLEXIBLE MEMBRANE WALL FLASHING - SELF ADHERED (S.A.F.F)

A. Flashing for windows/door openings as indicated on drawing.
1. Grace Vycor Plus V40" by Grace Building Products. (Basis of Design)
2. Acceptable Manufacturers:
    a. CCW-705-TWF, by Carlisle Coatings and Waterproofing.
    b. Perma-Seal PE by Henry Co.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.3 ACCESSORIES

A. Surface conditioner: Perm-A-Barrier Surface Conditioner water-based latex surface treatment required for dirty or dusty surfaces or surfaces having irregular or rough textures or as recommended by barrier manufacturer.

B. Primer: Perm-A-BarrierWB Primer water-based primer required for cementitious and exterior gypsum sheathing substrates or as recommended by barrier manufacturer.

C. Wall Flashing: Perm-A-Barrier Wall Flashing self-adhesive, rubberized asphalt/polyethylene flashing tape or as recommended by barrier manufacturer.

D. Mastic: Bituthene Mastic Trowel Grade rubberized asphalt mastic for sealing patches, terminations, masonry ties, etc or as recommended by barrier manufacturer.

2.4 SEALANTS

A. As recommended by barrier manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

B. Correct conditions detrimental to the proper and timely completion of the work before proceeding with installation.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Protection: Mask adjoining surfaces not scheduled to be covered by air barrier to prevent spillage and overspray.

C. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's instructions and to ensure a watertight installation.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
   1. Install strips, transition strips and auxiliary materials in compliance with the air barrier manufacturer's instructions to form a seal with adjacent construction and maintain a continuous air barrier. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Apply primer to substrates at required rate and allow to dry.
      a. Limit priming to areas that will be covered by air barrier in same day.
      b. Re-prime areas exposed for more than 24 hours.
      c. Prime glass-mat-faced gypsum sheathing with the appropriate number of prime coats needed to achieve required bond, allowing for adequate drying time between coats.

3. Using accessory materials, continuously connect and seal air barrier membrane as indicated to concrete below-grade structures, floor-to floor construction, exterior door framing, exterior glazing and window systems, storefront systems, glazed curtain-wall systems, exterior louvers, roofing air barrier membrane and to other construction as necessary to form an uninterrupted and airtight barrier.
    a. Apply joint sealants within manufacturer's recommended application temperature ranges.
    b. Consult manufacturer when sealant cannot be applied within these temperature ranges.
4. Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than one inch of full contact.
5. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant recommended or approved by the air barrier manufacturer.
6. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
7. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

D. Air Barrier Coating:
1. Apply primer to substrates at required rate and allow to dry.
    a. Limit priming to areas that will be covered by air barrier in same day.
    b. Re-prime areas exposed for more than 24 hours.
    c. Prime glass-mat-faced gypsum sheathing with the appropriate number of prime coats needed to achieve required bond, allowing for adequate drying time between coats.
2. Install air barrier membrane in compliance with its manufacturer's instructions to form a seal with strips and transition strips, and to achieve a continuous unbroken air barrier. Apply to a minimum 60-mil dry film thickness (OFT).
3. Apply strip and transition strip a minimum of one inch onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches onto each surface in compliance with manufacturer's instructions.
4. Correction: At no cost to the Owner, either correct deficiencies that do not comply with specified requirements, as determined by the manufacturer's field representative and the Architect, or remove, repair substrates and reinstall.
5. Repair: At no cost to the Owner, repair or replace materials and accessories that become damaged and that cannot be satisfactorily repaired, as determined and directed by the manufacturer's field representative and the Architect.

E. Openings and Penetrations in Exterior Weather Barriers:

1. Install flashings in compliance with details on drawings and manufacturer-prepared instructions.
2. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges unless noted otherwise on drawings.
3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing unless noted otherwise.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.4 FIELD QUALITY CONTROL

A. Do not cover installed weather barriers until required inspections have been completed.

B. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air barrier system has been provided.
   3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
   4. Site conditions for application temperature and dryness of substrates have been maintained.
   5. Maximum exposure time of materials to UV deterioration has not been exceeded.
   6. Surfaces have been primed, if applicable.
   7. Laps in strips and transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fish-mouths.
   8. Termination sealant has been applied on cut edges.
   9. Strips and transition membrane have been firmly adhered to substrate.
   10. Compatible materials have been used.
   11. Transitions at changes in direction and structural support at gaps have been provided..

12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

D. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186.
2. Remove and replace deficient air barrier components and retest as specified above.

3.5 PROTECTION

A. Protect in place during the construction period against deterioration caused by exposure to ultraviolet (UV) rays and harmful weather, and against physical damage, as required by manufacturer.

END OF SECTION 07 25 00

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants.
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Silyl-terminated polyether joint sealants.
   4. Butyl joint sealants.
   5. Latex joint sealants.

B. Related Sections include the following:
   1. Division 8 Section "Glazing" for glazing sealants.
   2. Division 9 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   3. Division 9 Section "Ceramic Tile" for sealing tile joints.
   4. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 4-inch long

strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint material location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

E. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

F. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

G. Qualification Data: For Installer.

H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

J. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Reference Standards:
   1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2018 IBC, as Amended by CA
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
   5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
   6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)

7. Title 24 CCR, Part 6 - 2022 California Energy Code
8. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
9. Title 24 CCR, Part 10 - 2022 California Existing Building Code
10. Title 24 CCR, Part 11 - 2022 California Green Building Standards Code (Calgreen Code)

B. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 ENVIRONMENTAL REQUIREMENTS

A. Adhesives, sealants and caulks shall meet the following requirements of the following standards:
1. Adhesives, adhesive bonding primers, adhesive primers, Sealants, sealant primers and caulks shall comply with local or regional air pollution control or air quality management district rules as applicable or SCAQMD Rule 1168 VOC limits as shown on tables 5.504.4.1 and 5.504.4.2. Such products shall also comply with rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except aerosol products as specified in subsection 2 noted below.
2. Aerosol adhesives and smaller unit sizes of adhesives and sealant or caulking compounds (in units, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on the use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with section 94507.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated. Notify Architect/ Inspector of the non-compliant condition.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 5 years (20 years for Silicone Sealants) from the date of Final Completion

B. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within the specified warranty period.
   1. Warranty Period: 2 years final Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Joint Sealants: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Dow Corning Corp.

2. Pecora Corporation.
3. United States Gypsum Co
4. Tremco, Inc.
5. Bostik Construction Products Division
6. General Electric Sealants
7. WR Meadows
8. Or equal. (Reference substitution requirements in Section 01 60 00)

2.2 MATERIALS, GENERAL

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

C. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

D. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

F. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 JOINT SEALANTS

A. Type A - Acrylic Latex: One-part, non-sag, mildew resistant acrylic emulsion compound complying with ASTM C834, Type OP, Grade NF, formulated to be paintable.

1. Tremco Inc., "Tremflex 834"
2. Bostik Construction Products Division, "Chem-Calk 11200".
3. Pecora Corporation, "AC-20"

B. Type B - Butyl Sealant: One-part, non-sag solvent-release-curing sealant complying with ASTM 1311 and formulated with a minimum of 75 percent solids.
1. Tremco Inc., Tremco "Bitul Sealant"
2. Bostik Construction Products Division, "Chem-Calk 300".
3. Pecora Corporation, "BC-158".

C. Type C - Silicone Sealant: One-part nonacid-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
1. Dow Corning Corp., "Dow Corning 791".
2. General Electric Co., "SCS 2000 Silpruf".
3. Pecora Corp., "890FTS"

D. Type D - Neutral-Curing Silicone Sealant: One part medium modulus neutral-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
1. Dow Corning Corp., "Dow Corning 899".
2. General Electric Co., "SSG 4000AC Ultraglaze".
3. Tremco, Inc., "Spectrum 3".
4. Pecora Corp., "895NST".

E. Type E - One-Part Mildew-Resistant Silicone Sealant: Complying with ASTM C920, Type S, Grade NS, Class 25.
1. Dow Corning Corp., "Dow Corning 791".
2. General Electric Co., "SCS 1700 Sanitary".
3. Tremco, Inc., "Proglaze"
4. Pecora Corp., "860" or "894NST"

F. Type F - Multi-Part Pourable Sealant: Complying with ASTM C920, Type M, Grade P, Class 25. Shore A hardness +40.
1. Tremco, Inc., "Vulkem 45SSL".
2. Pecora Corp., "Dynatred" or "Urexpan NR-200".
3. W.R. Meadows, "Pourthane SL".

G. Type G - Acoustical Sealant: Nondrying, nonhardening permanently flexible conforming to ASTM D217.
1. Pecora Corp., "BA-98 Acoustical Sealant"
2. Tremco, Inc., "Tremco Acoustical Sealant".
3. United States Gypsum Co., "Sheetrock Acoustical Sealant".

H. Type H - Sound and Fire Protective Rated Moldable Putty Pads as wall opening protective materials when code required in fire-rated walls.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width

E. Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with manufacturers and document requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

C. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include examples of the following:

    a. Asphalt
    b. Concrete.
    c. Masonry
    d. Unglazed surfaces of ceramic tile.
    e. Exterior insulation and finish systems

B. Remove laitance and form-release agents from concrete.
1. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include examples of the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Perform preparation in accordance with ASTM C1193.

E. Protect elements surrounding the Work of this Section from damage or disfiguration Joint Priming:

F. Prime joint substrates, where recommended in written form by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

G. Joint Priming: Prime joint substrates, where recommended in written form by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces

H. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form

smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth according to Figure 8C in ASTM C 1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT LOCATION SCHEDULE

SCHEDULE ***(MAKE SELECTIONS AND DELETE MATERIALS THAT DO NOT APPLY) "TO MATCH ADJACENT MATERIAL" IS RECOMMENDED WHERE PRACTICAL***

Type	Location	Color
Type A - Acrylic Latex Cure	All interior joints not otherwise scheduled	To match adjacent surfaces
Type B - Butyl	Under thresholds	White or Translucent
Type C - One-Part Nonacid Curing Silicone	Exterior door, entrance & window frames. Exterior & Interior vertical joints in concrete & masonry, metal flashing	Aluminum, to match adjacent material
Type D - Neutral-Curing Silicone	Joints within aluminum entrance systems, glass and glazing	Translucent, White, or Aluminum
Type E - Mildew-Resistant Silicone	Interior joints in ceramic tile and at plumbing fixtures	White or Translucent
Type F - Multipart Pourable Urethane	Exterior & interior joints in horizontal surfaces of concrete; between metal & concrete masonry and mortar	To match adjacent material
Type G - Acoustical Sealant	In sound rated walls between stud track/runner and adjacent construction. Between outlet boxes and gypsum board.	White or Translucent
Type H - Sound and Fire Protective Rated Moldable Putty Pads	At fire-rated wall openings when code required, such as electric boxes. In sound rated walls at electric boxes.	Red

END OF SECTION 07 92 00

SECTION 08 17 43 - FRP/ ALUMINUM HYBRID DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door.
B. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door installed in Aluminum Framing.
C. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door installed in Thermally Broken Aluminum Framing.
D. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door installed in Retrofit Aluminum Framing.

1.02 RELATED SECTIONS

A. Section 08 80 00 – Glazing.
B. Section 08 71 00 – Door Hardware.
C. Section 08 90 00 –Louvers and Vents.

1.03 REFRENCES

A. AAMA 1304 – Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems.
B. ASTM-B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
C. ASTM-B221 – Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
D. ASTM-C518 – Standard test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.
E. ASTM-D256 – Standard Test Methods for Determining the Pendulum Impact Resistance of Plastics.
F. ASTM-D570 – Standard Test Method for Water Absorption of Plastics.
G. ASTM-D638 – Standard Test Method for Tensile Properties of Plastics.
H. ASTM-D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
I. ASTM-D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
J. ASTM-D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.
K. ASTM-D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
L. ASTM-D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
M. ASTM-D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
N. ASTM-D3029 – Test Methods for Impact Resistance of Flat Rigid Plastic Specimens by Means of a Tup (Falling Weight) (Withdrawn 1995) (Replaced by ASTM-D5420).

O. ASTM-D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/ Products.

P. ASTM-D6670 – Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/ Products.
Q. ASTM-E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
R. ASTM-E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
S. ASTM-E330 – Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
T. NFRC 100 – Procedure for Determining Fenestration Products U-Factors.
U. NFRC 400 – Procedure for Determining Fenestration Products Air Leakage.
V. TAS 201 – Impact Test Procedures.
W. TAS 202 – Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure.
X. TAS 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

1.04 SUBMITTALS

A. Must comply with Section 01 33 00 – Submittal Procedures.
B. Action Submittals/ Informational Submittals.
    1. Product Data.
        a. Submit manufacturer's product data sheets, catalog pages illustrating the products, description of materials, components, fabrication, finishes, installation instructions, and applicable test reports.
    2. Shop Drawings.
        a. Submit manufacturer's shop drawings, including elevations, sections, and details indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
    3. Samples.
        a. Submit manufacturer's door sample composed of door face sheet, core, framing and finish.
        b. Submit manufacturer's sample of standard colors for door face and frame.
    4. Testing and Evaluation Reports.
        a. Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance requirements listed in Section 2.04.
    5. Manufacturer Reports.
        a. Manufacturer's Project References.
            □□Submit list of successfully completed projects including project name, location, name of architect, type, and quantity of doors manufactured.
C. Closeout Submittals.
    1. Operation and Maintenance Manual.
        a. Submit manufacturer's maintenance and cleaning instructions for doors and frames, including maintenance and operating instructions for hardware.
    2. Warranty Documentation.
        a. Submit manufacturer's standard warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications.
   1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years concurrent successful experience.
   2. Door and frame components must be fabricated by same manufacturer.
   3. Evidence of a documented complaint resolution quality management system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery.
   1. Deliver materials to site in manufacturer's original, unopened, containers and packaging.
   2. Labels clearly identifying opening, door mark, and manufacturer.
B. Storage.
   1. Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.
C. Handling.
   1. Protect materials and finish from damage during handling and installation.

1.07 WARRANTY

A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
B. Standard Period.
   1. Ten years starting on date of shipment.
C. Limited lifetime
   1. Covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.
D. Finish
   1. Fluropan painted aluminum: 10 years.
   2. Painted SL-17, SL-18, SL-19, SL-20 face sheets: 5 years.
   3. Painted AF-100, AF-200, AF-150 frames, AF-250 frames: 3 years.
   4. Painted FR doors: 3 years.
   5. Stained SL-18 and SL-9 face sheets: 5 years.
   6. Anodized, aluminum:10 years.
   7. Thresholds do not have a finish warranty.

PART 2 PRODUCTS

2.01 FRP/ALUMINUM HYBRID DOORS

□□ Manufacturer.
   1. Special-Lite, Inc.
      a. PO Box 6, Decatur, Michigan 49045.
      b. Toll Free (800) 821-6531, Phone (269) 423-7068, Fax (800) 423-7610.
      c. Web Site www.special-lite.com.
      d. E-Mail info@special-lite.com.

2.02 DESCRIPTION

- Model.
  1. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door.
- Door Opening Size.
  1. 3′-0″ W x 7′-0″H
- Construction.
  1. Door Thickness.
     a. 1-3/4″.
  2. Stiles & Rails.
     a. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
     b. Minimum 2-5/16″ deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
     c. Screw or snap in place applied caps are not acceptable.
     d. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.
     e. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.
     f. Meeting stiles to include integral pocket to accept pile brush weather seal.
  3. Corners.
     a. Mitered.
     b. Secured with 3/8″ diameter full-width steel tie rod through extruded splines top and bottom which are integral to standard tubular shaped rails.
     c. 1-1/4″ x 1-1/4″ x 3/16″ 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.
     d. Weld, glue, or other methods of corner joinery are not acceptable.
  4. Core.
     a. Poured-in-place polyurethane foam.
     b. Laid in foam cores are not acceptable.
     c. Foam Plastic Insulated Doors: IBC 2603.4.
        1. Foam plastic shall be separated from the interior of a building by an approved thermal barrier.
        2. Approved thermal barrier must meet the acceptance criteria of the Temperature Transmission Fire Test and Integrity Fire Test as stated in NFPA 275.
        3. IBC 2603.4.1.7 foam plastic insulation, having a flame spread index less than 75 and a smoke developed index of not more than 450 shall be permitted as a door core when the face is metal minimum 0.032″ aluminum or 0.016″ steel.
        4. Standard door assembly can be tested to show it meets these requirements without the use of thermal barrier. If no independent testing conducted all doors with foam plastic core must have a thermal barrier.
  5. Face Sheet.
     a. Exterior
        1. 0.120″ thick, Sandstone texture, through color FRP sheet.
        2. Optional painted finish consult manufacturer.
        3. Class C standard.

b. Interior
1. 0.120" thick, Sandstone texture, through color FRP sheet.
2. Optional painted finish consult manufacturer.
3. Class C standard optional Class A available consult manufacturer.
c. Attachment of face sheet.
1. Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
2. Use of glue to bond face sheet to core or extrusions is not acceptable.

6. Cutouts.
a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
7. Hardware.
a. Pre-machine doors in accordance with templates from specified hardware manufacturers.
b. Surface mounted closures will be reinforced for but not prepped or installed at factory.
c. Factory install door hardware.
8. Reinforcements.
a. Aluminum extrusions made from 6061 or 6063 aluminum alloys.
b. Sheet and plate to conform to ASTM-B209.
c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
d. Bars and tubes to meet ASTM-B221.

□□ Sustainability Characteristics.
1. LEED Declaration.
a. Entrance Products contribute to point calculations for the following credits:
1. MR Credit 4.1 Recycled Content 10% (post-consumer = ½ pre-consumer) 1 point.
2. MR Credit 4.2 Recycled Content 20% (post-consumer = ½ pre-consumer) 1 point.
b. All aluminum extrusions are produced using prime-equivalent billet produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes. The USGBC classifies these extrusions as pre-consumer recycled material.
c. Manufacturing facility located within 500 miles of major components and materials, including aluminum extrusions.
d. The point of recovery and smelting of pre-consumer recycled material within 500 miles of the manufacturing facility.

2.03 FRAMING

□□ Framing
1. Aluminum Tube Framing with Applied Stops.
a. Model.
1. Choose an item.
b. Materials.
1. See 2.05.A.
c. Perimeter Frame Members.
1. Box type with 4 enclosed sides.
2. Factory fabricated.
3. Open-back framing is not acceptable.

d. Applied Door Stops.
   1. 5/8" x 1-1/4" or 5/8" x 1-3/4", 0.125" wall thickness, with screws and weather-stripping.
   2. Provide solid ½" aluminum bar behind door stop for closer shoe attachment.
   3. Pressure gasketing for weathering seal.
   4. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
e. Caulking.
   1. Caulk joints before assembling frame members.
f. Frame Member to Member Connections.
   1. Secure joints with fasteners.
   2. Provide hairline butt joint appearance.
g. Hardware
   1. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
   2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
   3. Factory install door hardware.
h. Anchors:
   1. Anchors appropriate for wall conditions to anchor framing to wall materials.
   2. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
   3. Secure head and sill members of transom, side lites, and similar conditions.

2. Thermally Broken Aluminum Framing.
   a. Model.
      1. Choose an item.
   b. Materials.
      1. See 2.05.A.
   c. Perimeter Frame Members.
      1. Storefront frame with thermally broken pocket filler.
      2. Factory fabricated.
      3. Open-back framing is not acceptable.
   d. Thermal Strut.
      1. Fiber reinforced plastic, no other materials will be accepted.
   e. Applied Door Stops.
      1. 5/8" x 1-1/4" or 5/8" x 1-3/4", 0.125" wall thickness, with screws and weather-stripping.
      2. Provide solid ½" aluminum bar behind door stop for closer shoe attachment.
      3. Pressure gasketing for weathering seal.
      4. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
      5. Minimum ½" aluminum bar reinforcement under doorstop for required hardware attachments, aluminum to meet ASTM-B221.
   f. Caulking.
      1. Caulk joints before assembling frame members.
   g. Frame Member to Member Connections.
      1. Secure joints with fasteners.
      2. Provide hairline butt joint appearance.

3. Shear block construction only, no screw spline allowed.

h. Hardware
1. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
3. Factory install door hardware.

i. Anchors:
1. Anchors appropriate for wall conditions to anchor framing to wall materials.
2. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
3. Secure head and sill members of transom, side lites, and similar conditions.

3. Retrofit Framing.
a. Model.
1. Choose an item.
b. Materials.
1. See 2.05.A.
c. Insert frame as indicated on the Drawings, using integral stop fitted with weather-stripping.
d. Corner joints of miter design, secure with furnished aluminum clips, and screw into place.
e. Hardware.
1. Pre-machine and reinforce insert frame members for hardware in accordance with manufacturer's standards and hardware schedule.
2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
3. Factory install hardware.
f. Anchors.
1. Anchors of suitable type to fasten insert framing to existing frame materials.
2. Minimum of 5 anchors on jambs up to 7'-4" height, 3 anchors on headers, and 1 additional anchor for each additional foot of frame.

4. Capping.
a. Model.
1. SL-70
b. Materials.
1. See 2.05.A.
2. Size as indicated on drawings.

5. AF-150.
a. Jamb Depth.
1. Custom size, see drawings.
b. Materials.
1. See 2.05.A.
c. Perimeter Frame Members.
1. ¼" thick pultruded fiberglass open throat with return.
2. Factory fabricated.
3. 2" or 4" face available for frame headers.
d. Transoms and Sidelites.
1. Same as perimeter frame members.
2. Removable stop for ¼", 5/8" or 1" glass or panels.

e. Integral Door Stops.
   1. 5/8" x 2-1/4".
f. Frame Assembly.
   1. Standard knock down.
   2. Optional chemically welded consult factory for details.
g. Frame Member to Member Connections.
   1. Corners mitered with 4" x 4" x 3/8" pultruded FRP angle reinforcement with interlocking pultruded FRP brackets.
   2. All member to member connections knocked down at factory unless chemically welded at factory requested.
   3. Provide hairline butt joint appearance.
h. Reinforcements.
   1. Standard.
      a. ¼" thick pultruded FRP chemically welded to frame at all hinge, strike, and closer locations.
   2. Optional
      a. Aluminum, contact factory for details.
i. Hardware
   1. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
   2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
j. Anchors:
   1. Masonry.
      a. Existing concrete or block punch and dimple.
      b. Sill anchor.
      c. Concealed existing masonry anchor.
      d. Fiberglass masonry t anchor.
   2. Drywall.
      a. Standard jamb anchor tuck.
      b. KD wrap.
      c. Optional punch and dimple tuck with either metal or wood studs.

6. AF-250.
   a. Jamb Depth.
      1. 5-3/4".
   b. Materials.
      1. See 2.05.A.
   c. Perimeter Frame Members.
      1. 3/16" thick pultruded fiberglass open throat with return.
      2. Factory fabricated.
      3. 2" or 4" face available for frame headers.
   d. Integral Door Stops.
      1. 5/8" x 2-1/4".
   e. Frame Assembly.
      1. Standard knock down.

2. Optional chemically welded consult factory for details.

f. Frame Member to Member Connections.
1. Corners mitered with 2" x 2" x 1/4" pultruded FRP angle reinforcement with interlocking pultruded FRP brackets.
2. All member to member connections knocked down at factory unless chemically welded at factory requested.
3. Provide hairline butt joint appearance.

g. Reinforcements.
1. ¼" thick pultruded FRP chemically welded to frame at all hinge, strike, and closer locations.

h. Hardware
1. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
2. Surface mounted closures will be reinforced for but not prepped or installed at factory.

i. Anchors:
1. Masonry.
a. Existing concrete or block punch and dimple.
b. Sill anchor.
c. Concealed existing masonry anchor.
d. Fiberglass masonry t anchor.
2. Drywall.
a. Punch and dimple for metal or wood studs.

2.04 PERFORMANCE

□□ Face Sheet.

1. Standard Interior and Exterior Class C 0.120" thick, Sandstone texture, through color FRP sheet.
a. Flexural Strength, ASTM-D790: 27 x 10^3 psi.
b. Flexural Modulus, ASTM-D790: 0.7 x 10^6 psi.
c. Tensile Strength, ASTM-D638: 18 x 10^3 psi.
d. Tensile Modulus, ASTM-D638: 1.0 x 10^6 psi.
e. Barcol Hardness, ASTM-D2583: 40.
f. Izod Impact, ASTM-D256: 7.0 ft-lb/in.
g. Gardner Impact Strength, ASTM-D5420: 30 in-lb.
h. Water Absorption, ASTM-D570: 0.16%/24hrs at 77°F.
i. Surface Burning, ASTM-E84: Flame Spread ≤ 200, Smoke Developed ≤ 450.
j. Chemical Resistance.
1. Excellent Rating.
a. Acetic Acid, Concentrated.
b. Acetic Acid, 5%.
c. Bleach Solution.
d. Detergent Solution.
e. Distilled Water.
f. Ethyl Acetate.
g. Formaldehyde.
h. Heptane.

i. Hydrochloric Acid, 10%.
j. Hydrogen Peroxide, 3%.
k. Isooctane.
l. Lactic Acid, 10%.

k. USDA/FSIS Requirements.
1. FRP face sheet with surfaseal is a finished outer surface material that is rigid; durable; non-toxic; non-corrosive; moisture resistant; a light, solid color such as white; easily inspected; smooth or an easily cleaned texture.
2. FRP face sheet with surfaseal does not contain any known carcinogen, mutagen, or teratogen classified as hazardous substances; heavy metals or toxic substances; antimicrobials; pesticides or substances with pesticidal characteristics.

2. Optional Interior Face Only Class A 0.120" thick, Sandstone texture, through color FRP sheet.
a. Flexural Strength, ASTM-D790: 14 x 10^3 psi.
b. Flexural Modulus, ASTM-D790: 0.4 x 10^6 psi.
c. Tensile Strength, ASTM-D638: 7 x 10^3 psi.
d. Tensile Modulus, ASTM-D638: 0.8 x 10^6 psi.
e. Barcol Hardness, ASTM-D2583: 45.
f. Izod Impact, ASTM-D256: 4.0 ft-lb/in notched.
g. Water Absorption, ASTM-D570: 0.16%/24hrs at 77°F.
h. Surface Burning, ASTM-E84: Flame Spread ≤ 25, Smoke Developed ≤ 450.
i. Taber Abrasion Resistance, Taber Test: 0.036% Max Wt. Loss, cs-17 wheels, 1000g. Wt., 25 cycles.

□□ Door Core.
1. Density, ASTM-D1622: ≤ 5.0 pcf.
2. Compressive Properties, ASTM-D1621: Compressive Strength ≥ 60 psi, Compressive Modulus ≥ 1948 psi.
3. Tensile and Tensile Adhesion Properties, ASTM-D1623: Tensile Adhesion, 3" x 3" FRP Facers ≥ 53 psi, Tensile Adhesion, 1" x 1" Foam ≥ 104 psi.
4. Thermal and Humid Aging, ASTM-D2126: Volume Change at 158 °F, 100% humidity, 14 days ≤ 13%.
5. Thermal Conductivity, ASTM-C518, Thermal Resistance ≥ 0.10 m^2K/W.

□□ Door Panel.
1. Indoor Air Quality, ASTM-D5116, ASTM-D6607: GreenGuard, GreenGuard Gold.

□□ Door and Aluminum Tube Frame Assembly.
1. Structural Performance, ASTM E-330.
a. Single or Pair of Doors, 6'4" x 7'2" overall size, single point latching.
1. ± 90 psf design pressure, pass.

□□ Door and Thermally Broken Aluminum Frame Assembly.
1. Thermal Transmittance, NFRC 100.
a. Opaque Swinging Door (< than 50% glass)
1. U-Factor = 0.33 Btu/hr·ft^2·°F.
b. Commercially Glazed Swinging Entrance Door (> than 50% glass)
1. U-Factor = 0.62 Btu/hr·ft^2·°F.
2. Air Leakage, NFRC 400, ASTM-E283.

a. Opaque Swinging Door (< than 50% glass)
1. 0.02 cfm/sqft @ 1.57 psf.
2. 0.02 cfm/sqft @ 6.24 psf.
b. Commercially Glazed Swinging Entrance Door (> than 50% glass)
1. 0.22 cfm/sqft @ 1.57 psf.
2. 0.42 cfm/sqft @ 6.24 psf.
3. Sound Transmission, ASTM-E90: STC = 30, OITC = 30.

□□ Door and AF-150 Frame Assembly.
1. Thermal Transmittance, NFRC 100.
a. Opaque Swinging Door (< than 50% glass)
1. U-Factor = 0.33 Btu/hr·ft^2·°F.
b. Commercially Glazed Swinging Entrance Door (> than 50% glass)
1. U-Factor = 0.58 Btu/hr·ft^2·°F.
2. Air Leakage, NFRC 400, ASTM-E283.
a. Opaque Swinging Door (< than 50% glass)
1. 0.11 cfm/sqft @ 1.57 psf.
2. 0.07 cfm/sqft @ 6.24 psf.
b. Commercially Glazed Swinging Entrance Door (> than 50% glass)
1. 0.03 cfm/sqft @ 1.57 psf.
2. 0.04 cfm/sqft @ 6.24 psf.

□□ AF-150 Framing.
1. Tensile Strength, ASTM-D638: 15,900 psi.
2. Tensile Modulus of Elasticity, ASTM-D638: 1.58 x 10^6 psi.
3. Maximum Compressive Strength, ASTM-D695: 15,500 psi.
4. Compressive Modulus of Elasticity, ASTM-D695: 6.7 x 10^5 psi.
5. Flexural Strength, ASTM-D790: 39.3 x 10^3 psi.
6. Flexural Modulus, ASTM-D790: 1.23 x 10^6 psi.
7. Izod Impact, ASTM-D256: 8.1 ft-lb/in.
8. Barcol Hardness, ASTM-D2583: 57.
9. Specific Gravity, ASTM-D792: 1.45 @ 23 °C.
10. Density, ASTM-D792: 1445.6 kg.m^3 @ 23 °C.
11. Coefficient of Linear Expansion, ASTM-D696: 1.26 x 10^{-5} in/in/°F.
12. Short Beam Strength, ASTM-D2344: 3,980 psi.
13. Fastener Withdrawal, ASTM-D1761: 924 lbs.
14. Percent Fiberglass: 60%.

2.05 MATERIALS

□□ Aluminum Members.
1. Aluminum extrusions made 6061 or 6063 aluminum alloys.
2. Sheet and plate to conform to ASTM-B209.
3. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.

□□ Fiberglass.
1. See 2.02.C.5.

□□ Fasteners.

1. All exposed fasteners will have a finish to match material being fastened.
2. 410 stainless steel or other non-corrosive metal.
3. Must be compatible with items being fastened.

2.06 FABRICATION

□□ Factory Assembly.
1. Door and frame components from the same manufacturer.
2. Required size for door and frame units, shall be as indicated on the drawings.
3. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
4. All cut edges to be free of burs.
5. Welding of doors or frames is not acceptable.
6. Maintain continuity of line and accurate relation of planes and angles.
7. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

□□ Shop Fabrication
1. All shop fabrication to be completed in accordance with manufactures process work instructions.
2. Quality control to be performed before leaving each department.

2.07 FINISHES

□□ Door.
1. Aluminum.
   a. Mill.
      1. AA-M10C22A21-Flash.
   b. Anodizing.
      1. Class 1 Anodizing, minimum 0.7 mils thick.
         a. Color.
            1. Choose an item.
   c. Paint.
      1. Aluminum.
         a. FLuropan®.
            1. Topcoat.
               a. 70% polyvinylidene difluoride (PVDF) resin, meets or exceeds all AAMA 2605 specifications
            2. Color.
               a. Consult manufacturer.
   d. Powder Coat.
      1. Special-Lite's® Wood Expressions™.
         a. Color.
            1. Choose an item.
         b. Durability against humidity, warping and cracking.
         c. Resists fading from UV rays.
         d. Natural, high-definition grains with the look and feel of real wood.
         e. Durable powder coat protects against scratching.
2. FRP Face Sheets
   a. Through color.

1. Color.
   a. Choose an item.
b. Painted.
   1. Color.
   2. Choose an item.
   3. Custom colors available consult manufacturer.

□□ Frame

1. Aluminum.
   a. Mill.
      1. AA-M10C22A21-Flash.
   b. Anodizing.
      1. Class 1 Anodizing, minimum 0.7 mils thick.
         a. Color.
            1. Choose an item.
   c. Paint.
      1. Aluminum.
         a. Fluropan®.
            1. Topcoat.
               a. 70% polyvinylidene difluoride (PVDF) resin, meets or exceeds all AAMA 2605 specifications
            2. Color.
               a. Consult manufacturer.
2. Fiberglass.
   a. Two-component flexible acrylic urethane Satin topcoat. (STANDARD)
      1. Color.
      2. Choose an item.
      3. Custom colors available consult manufacturer.
      4. Excellent exterior durability.
      5. Unique, high-solids, high-build, multifunctional coating.
      6. Low VOC, Satin coating.
      7. Impact Resistance, ASTM D-4226 Minimum 1.2 in/lb/mil
      8. Color retention: ≤1Δ (CIE L.a.b.), Montreal 45° South: 12 months
      9. Very good chemical resistance.

   b. Two-component acrylic urethane enamel Gloss topcoat. (OPTIONAL)
      1. Color.
      2. Custom colors available consult manufacturer.
      3. Unique, high-solids, high-build, multifunctional coating.
      4. Low VOC, Gloss coating.
      5. Impact Resistance, ASTM-D2794: 80-102 in/lb (direct), 40-80 in/lb (reverse) @ 1.5 mils thickness.
      6. Color retention: Δ E < 5 (CIE L.a.b.), Florida Exposure: 18 months
      7. Excellent chemical resistance.

2.08 ACCESSORIES

- ☐☐ Vision Lites.
  1. Factory Glazing.
     a. Model.
        1. Choose an item.
     b. Glazing Thickness.
        1. 1/4".
     c. Rectangular Lites.
        a. Size, as indicated on drawings.
     2. Rectangular Vision Lite Accessories.
        a. Security Grate.
           1. SL-SG349.
              a. Frame perimeter is 1" x 1" x 1/8" steel angle.
              b. Grate material is 14-gauge steel sheet perforated with ¼" diameter round holes.
        b. Vandal Screen.
           1. SL-SG350.
              a. Frame perimeter is aluminum.
              b. Screen material is 16-gauge stainless steel sheet perforated with ¼" diameter round holes.
        c. Louvers.
           1. Size, as indicated on drawings.
           2. Factory installed.
           3. 1" thick Y-Type fixed blade, 12" minimum from the bottom of the door.
           4. Exterior side of louver shall be free of fasteners.
           5. Optional insect screen.
        d. Privacy Vision Panel
           1. SL-PVP.
              a. Size.
                 1. NL - 8" x 30"
              b. Glazing.
                 1. Overall glass thickness, 1".
                 2. Outer glazing, ¼" Tempered Safety Glass.
                 3. Minimum Optical Transparency >72%.
              c. Finish.
                 1. Select from manufacturers standard colors.
                 2. Black Perimeter.
                 3. White Perimeter.
        e. Finish.
           1. Color.
     3. Other Shapes.
        a. Attach drawing for vision lite shape.
- ☐☐ Flush Vision Panels
  1. Model.

a. FLush Vision Panel (SL-FVP)
2. Size.
   a. NL - 8" x 30"
3. Factory Installed
4. Glazing.
   a. Overall thickness to match door, 1-3/4".
   b. Outer glazing, 1/4" Tempered Safety Glass.
   c. Minimum optical transparency >72%.
5. Finish.
   a. Select from manufacturers standard colors.
      1. Black Perimeter.
      2. White Perimeter.
6. Sealant.
   a. Silicone structural glazing.
   b. Color to match perimeter.
7. Privacy Louvers
   a. None
   b. 316-Grade Stainless Steel Handles.

□□ Hardware.

1. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.
2. Factory install hardware.
3. Hardware Schedule.
   a. As specified in Section 08 71 00.
      1. Hinges.
         a. Choose an item. Click or tap here to enter text.
      2. Locking Hardware.
         a. Click or tap here to enter text.
      3. Flush/ Surface Bolts.
         a. Click or tap here to enter text.
      4. Door Pulls.
         a. Choose an item.
      5. Push Bars.
         a. Choose an item.
      6. Concealed Prox. Reader.
         a. Click or tap here to enter text.
      7. Concealed adjustable bottom brush.
         a. SL-301.
            1. Not for use with CVR type hardware.
      8. Concealed adjustable meeting stile astragal.
         a. Adjustable astragal by Special-Lite.
      9. Mullions.
         a. Model.

1. Choose an item.

10. Thresholds.
    a. Aluminum threshold by Special-Lite.
    b. Or reinstall (E) threshold per drawings

PART 3 EXECUTION

3.01 EXAMINATION
- □□ Examine areas to receive doors.
- □□ Notify architect of conditions that would adversely affect installation or subsequent use.
- □□ Do no proceed with installation until unsatisfactory conditions are corrected.

3.02 PREPARATION
- □□ Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.03 ERECTION
- □□ Install doors in accordance with manufacturer's instructions.
- □□ Install doors plumb, level, square, true to line, and without warp or rack.
- □□ Anchor frames securely in place.
- □□ Separate aluminum from other metal surfaces with bituminous coatings or other means approved by architect.
- □□ Set thresholds in bed of mastic and back seal.
- □□ Install exterior doors to be weathertight in closed position.
- □□ Repair minor damages to finish in accordance with manufacturer's instructions and as approved by architect.
- □□ Remove and replace damaged components that cannot be successfully repaired as determined by architect.

3.04 FIELD QUALITY CONTROL
- □□ Manufacture's Field Services.
  - □□ Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.05 ADJUSTING
- □□ Adjust doors, hinges, and locksets for smooth operation without binding.

3.06 CLEANING
- □□ Clean doors promptly after installation in accordance with manufacturer's instructions.
- □□ Do not use harsh cleaning materials or methods that would damage finish.

3.07 PROTECTION
- □□ Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 08 17 43

SECTION 08 41 00 - ALUMINUM ENTRANCE AND STOREFRONT

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes aluminum entrance and storefront and related work as shown and specified.

1.03 REFERENCES

A. American Architectural Manufacturers Association (AAMA)
B. American Society for Testing and Materials (ASTM)
C. Aluminum Association (AA)

1.04 SUBMITIALS

A. Product Data:
   a. Aluminum Entrance and Storefront: None required for specified products; required for alternate products.
B. Shop Drawings: Submit manufacture and installation details, including fastenings, for review.
C. Samples:
   a. Aluminum Entrance and Storefront: If specifically requested for specified products; required for alternate products. Submit manufacturer's standard colors.
D. Certificates: Storefront shall bear a permanently installed "AAMA Prime and Replacement Label" bearing the manufacturers name, product series number, grade and class designations. Do not install label in exposed location.
E. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
F. Closeout Submittals:
   0 & M Manuals: Maintenance instructions and installation Manual.
   Guarantee: Provide completed form per Article 1.5.

1.05 QUALITY ASSURANCE

A. Design Requirements: Aluminum frame members must span vertically to withstand 25 pounds per square foot wind load, minimum, per CBC; provide internal reinforcing as required; maximum deflection of L/175 of clear span or maximum of 3/4 inch.
B. Single Source Responsibility:
   a. Obtain entrances and storefront systems and finish through one source from a single manufacturer.

C. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

1.06 GUARANTEE

A. Aluminum Entrance and Storefront: Provide manufacturer's warranty that products are to be free from defects in materials and workmanship for 3 years beginning at date of acceptance by Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect prefinished components with wrapping or strippable coating; adhesive papers and sprayed coatings are not acceptable.

1.08 PROJECT CONDITIONS

A. Do not install sealants when temperature is less than 40 degrees F.

PART 2 -PRODUCTS

2.01 ALUMINUM ENTRANCE AND STOREFRONT (ALST)

A. Acceptable Products:

1. Aluminum-Framed Storefront

a. Basis of Design:
Manufacturer: Arcadia, Inc., 2301 E Vernon, Vernon, CA.
Telephone 323/269-7300, Fax 323/269-7390.

Product: AFG451T Series, 2" x 4-1/2" **Thermally broken**; center glazed system, screw spline, shear block, compensating stick or punched opening fabrication for 1" glass.

b. Or approved thermally-broken equal products by:
Old Castle
Vistawall
U.S. Aluminum Systems
Traco Co., Inc.

B. System Description

2. General: In addition to requirements shown or specified, comply with:

a. Applicable provisions of AAMA Aluminum Storefront and Entrance Manual for design, materials, fabrication, and installation of component parts.

3. Design Requirements: Arcadia AG451T Series is a framing system that provides for flush glazing on all sides without projected stops, with glass in the center of the frame. Framing system suitable for outside or inside glazing.
4. Performance Requirements:
    a. Limit air leakage through assembly to 0.06 CFM/min/sq. ft. (.00003 m3/sm2) of wall area at 6.24 PSF (300 Pa) as measured in accordance with ASTM E283.
    b. Water Resistance: No water leakage when measured in accordance with ASTM E331 with a static test pressure of 8 PSF(383 Pa).
    c. Limit mullion windload deflection of L/175 with full recovery of glazing materials, when measured in accordance with ASTM E 330.
    d. System shall not deflect more than 1/8" at the center point, or 1/16" at the center point of a horizontal member, once deadload points have been established.
    e. System shall accommodate expansion and contraction movement due to surface temperature differential of 180 degrees F.
    f. Seismic testing shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.
    g. Thermal Performance – When tested in accordance with AAMA 1503.1 the following results should be attained: U-Maximum .63/CRF – minimum of 59.
    h. National Fenestration Rating Council (NFRC) specific application evaluation.

C. Framing Materials and Accessories
    a. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6).
    b. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM.A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.
    c. Glazing Gasket
    d. Compression-type design, replaceable, molded, or extruded, or ethylene propylene diene monomer (EPDM).
    e. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.

D. Finish: Clear Anodized, Architectural Class I.
E. Glass: As shown; refer to Section 08810 -GLASS AND GLAZING.
F. Fasteners: As recommended by manufacturer to meet wind pressures shown.
G. Protective Coatings:
    a. General: Bituminous, FS TT-C-494, Type II.
    b. Gasketing: Chromate type.
H. Sealant: Apply a high-performance, single-component, moisture-cure, ultralow modulus silicone sealant like Spectrem 1 by Tremco or approved equal and in accordance with manufacturer's written installation guidelines.

I. System Fabrication
   a. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system.
   b. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements, for hardware attachment, and as indicated.
   c. Fasteners shall be so located as to ensure concealment from view in the final assembly.

PART 3 -EXECUTION

3.1 EXAMINATION
A. Examine conditions of work in place before beginning work, report defects.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Take field measurements, report variance between plan and field dimensions.

3.3 INSTALLATION
A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
B. Storefront:
Install level, plumb, straight and aligned with adjacent surfaces, with hairline watertight joints; free of dents, buckles, twists, or other imperfections, as shown. Install flashings where shown.
Anchor to adjacent structure; permit sufficient adjustment to accommodate construction tolerances and other irregularities. Use No. 12 sheet metal screws, or wood screws at 18 inches on center with a minimum of 2 inches penetration into structure.
Tolerances: Maximum variation from plumb of 0.06 inch every 3'-0" non-cumulative or 1/16 inch per 10'-0", whichever is less. Maximum misalignment of 2 adjoining members abutting in plane of 1/32 inch.
Thermal Isolation: Provide where components penetrate or disrupt building insulation. Coordinate attachment and seal of perimeter air and vapor barrier materials.
C. Glazing:
General: As specified under Section 08810 -GLASS AND GLAZING.
Glazing Stops: Anchor glass holding assemblies with frame clips and machine screws.
E. Dissimilar Materials: Isolate from other metals, plaster, or concrete.
F. Sealant: Install per Section 079010 -JOINT SEALERS.

3.4 ADJUSTING
A. Prior to acceptance, adjust moveable parts to assure smooth operation.

3.5 CLEANING

A. Remove protective covering per manufacturer's instructions.

B. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

C. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 08 41 00

SECTION 08 71 00
Door Hardware

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. [illegible]

1.02 SUMMARY

A. [illegible]
B. [illegible]

1. [illegible]
2. [illegible]

1.03 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

A. [illegible]
B. [illegible] – Builders' Hardware Manufacturers Association
C. [illegible]
D. [illegible]
E. [illegible]

1. [illegible]
2. [illegible]

F. [illegible]

1. [illegible]
2. [illegible]

G. [illegible]
H. [illegible]

1.04 SUBMITTALS & SUBSTITUTIONS

A. [illegible]
B. [illegible]
C. Submit schedule organized vertically into "Hardware Sets" with index of doors and headings,

1. [illegible]
   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. [illegible]
2. [illegible]
   a. [illegible]
   b. [illegible]

Catalog cuts and manufacturer's technical data and

1.05 QUALITY ASSURANCE

manufacturers' installation and adjustment and

1.06 DELIVERY, STORAGE AND HANDLING

1.07 WARRANTY

1.08 MAINTENANCE

1.09 PRE-INSTALLATION CONFERENCE

PART 2 - PRODUCTS

SECTION 08 71 00
Door Hardware

2.01 MANUFACTURERS

2.02 MATERIALS

SECTION 08 71 00
Door Hardware

capable of UL listing of 3 hours on a 4’ x 10’ opening

Modular / “plug in” request to exit switch

“L” Series as scheduled with “” Style Lever and “” Style Rose.

Latchbolt shall have ¾” throw and be non

The deadbolt, when used, shall be 1” throw stainless steel with a ¾” internal engagement

designed to “break away” at a maximum of 75psi torque.

rolled steel. Mounting screws of ¼” diameter steel and

Strike alloy deadbolt with reinforcer and two 3” long screws. ANSI A156.5, 2001 Grade 1

All latchbolts shall be deadlocking with ¾” throw and have a self

Lever Trim: “Breakaway” design, forged brass or bronze escutcheon with a minimum of .130” thickness, match lockset lever design.

9/16” steel stud shoulder bolts, shall be incorporated in regular arms, hold

with requirements in Division 7 “Thermal and Moisture Protection”.

2.03 KEYING

SECTION 08 71 00
Door Hardware

[illegible]

[illegible]

[illegible]

[illegible]

3.03 ADJUST AND CLEAN

[illegible]

3.04 HARDWARE LOCATIONS

[illegible]

3.05 FIELD QUALITY CONTROL

A. [illegible]

3.06 SCHEDULE

[illegible]

Manufacturers Abbreviations (Mfr.)

SECTION 08 71 00
Door Hardware

HARDWARE GROUP NO. 01

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL VESTIBULE LOCK	ND93TD RHO XN12-035	626	SCH
2	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	LOCK GUARD	LG12	630	IVE
1	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS18S CAN'T BE USED)	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 02

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL OFFICE LOCK	ND91TD RHO	626	SCH
2	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	LOCK GUARD	LG12	630	IVE
1	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS18S CAN'T BE USED)	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	THRESHOLD	PER DETAIL		

SECTION 08 71 00
Door Hardware

HARDWARE GROUP NO. 03

2	EA	CONT. HINGE	224XY	628	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	FIRE EXIT HARDWARE	PA-AX-99-EO-F	626	VON
1	EA	FIRE EXIT HARDWARE	PA-AX-99-L-NL-F-06	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
2	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
2	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS18S CAN'T BE USED)	630	GLY
2	EA	SURFACE CLOSER	4040XP EDA TB	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
2	EA	DOOR SWEEP	328AA	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	THRESHOLD	PER DETAIL		

SECTION 08 71 00
Door Hardware

HARDWARE GROUP NO. 04

2	EA	CONT. HINGE	224XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-L-DT-06	626	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-L-KC-06	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
4	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
2	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS18S CAN'T BE USED)	630	GLY
2	EA	SURFACE CLOSER	4040XP EDA TB	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
2	EA	DOOR SWEEP	328AA	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 05

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94TD RHO	626	SCH
1	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	SURFACE CLOSER	4040XP RW/PA TB (MOUNT PULL SIDE)	689	LCN
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	EA	DOOR SWEEP	153A	A	ZER
1	EA	THRESHOLD	PER DETAIL		

SECTION 08 71 00
Door Hardware

HARDWARE GROUP NO. 06

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94TD RHO	626	SCH
1	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	LOCK GUARD	LG12	630	IVE
1	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS18S CAN'T BE USED)	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 07

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PRIVACY W/INDICATOR	LV9056T 06A L583-363 L283-722	626	SCH
1	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	SURFACE CLOSER	4040XP RW/PA TB (MOUNT PULL SIDE)	689	LCN
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	EA	DOOR SWEEP	153A	A	ZER
1	EA	THRESHOLD	PER DETAIL		

SECTION 08 71 00
Door Hardware

HARDWARE GROUP NO. 08

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	ADA STOREROOM LOCK	ND81TD RHO	626	SCH
1	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	LOCK GUARD	LG12	630	IVE
1	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS18S CAN'T BE USED)	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 09

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	ADA STOREROOM LOCK	ND81TD RHO	626	SCH
1	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	SURFACE CLOSER	4040XP RW/PA TB (MOUNT PULL SIDE)	689	LCN
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436/FS438 AS REQ.	626	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	EA	DOOR SWEEP	153A	A	ZER
1	EA	THRESHOLD	PER DETAIL		

SECTION 08 71 00
Door Hardware

HARDWARE GROUP NO. 10

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	LOCK GUARD	LG12	630	IVE
1	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS18S CAN'T BE USED)	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	SET	HEAD & JAMB SEALS	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 11

1	EA	GATE HINGE & CLOSER	LOCINOX MAMMOTH-180	AL	LOC
1	EA	ELEC PANIC HARDWARE	LD-RX-LC-PA-AX-98-EO-WH	630	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-400-993R-50-MT-RHO-J-LRX-4B (PROVIDED BY DIVISION 28)	626	SCE
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	FLOOR STOP	FS18L	BLK	IVE

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Aluminum Windows.
   2. Doors.

B. Related Sections include the following:
   1. Division 8 Section "FRP Aluminum Hybrid Doors".
   2. Division 8 Section “Aluminum Entrance and Storefront”.

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

E. Fire Rated Glass: Glass that is manufactured and tested by a testing lab/ agency recognized by DSA.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300.

1.5 SUBMITTALS

A. Concurrent Review Requirements: Submit submittals of this section with other sections requiring glazing specified in this section.
   1. Division 8 Section "FRP Aluminum Hybrid Doors".
   2. Division 8 Section “Aluminum Entrance and Storefront”.

B. Product Data: For each glass product and glazing material indicated.

C. Samples: For each glazing products, in the form of 12-inch- square Samples for glass and of 12-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
   1. Insulating glass for each designation indicated.
   2. Fire-rated glazing.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
   1. List by windows and door types scheduled on Drawings.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

F. Qualification Data: For installers. Minimum of 10 years of documented experience for supervisory staff in the installation of glass and glazing.

G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

H. Product Test Reports: For each types of glazing products specified.

1.6 QUALITY ASSURANCE

A. Reference Standards:
1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA
4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
6. Title 24 CCR, Part 5 – 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)
7. Title 24 CCR, Part 6 - 2022 California Energy Code
8. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
9. Title 24 CCR, Part 10 - 2022 California Existing Building Code

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glass: Obtain glazing products through one source from a single manufacturer for each glass type.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

G. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

H. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

I. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

J. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

K. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years.

C. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Fire-Rated Glass Manufacturers: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. All Weather
   2. Vitro Architectural Glass (Basis of Design).
   3. Guardian.
   4. Pilkington.
   5. Visteon.
   6. Or equal (Reference substitution requirements in Section 01 60 00).

B. Non-Fire-Rated Glazing Fabricators: Subject to compliance with requirements, provide either the named fabricator or an equal fabricator by one of the other fabricators specified.
   1. Oldcastle Glass. (Basis of Design)
   2. Viracon.
   3. Guardian.
   4. Or equal (Reference substitution requirements in Section 01 60 00).

C. Fire-Rated Glazing Fabricators: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. FireLite NT by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products (Basis of Design)
      a. Premium grade, lamination on one side, 3/16 inch thick.
   2. Interedge Technologies.
   3. Oldcastle Glass.
   4. Pilkington.
   5. Pyran Star F by Schott.
   6. Safti.
   7. Or equal (Reference substitution requirements in Section 01 60 00)

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass (Safety Glass): ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
   1. For uncoated glass, comply with requirements for Condition A.

2. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

C. Tinted Insulating-Glass Units: Insulated glass units for all exterior storefronts, doors and aluminum windows: Double pane, low-e with glass to elastomer edge seal. Outer pane of tinted glass, inner pane of clear glass. Place reflective coating on No.2 surface within the unit.
1. Product: Solarban 60 Gray by Vitro Architectural Glass
2. Visible Transmittance: 35%.
3. Visible Light Reflectance: 7%.
4. U-Value:
   a. Winter Night time: 0.29.
   b. Summer Day time: 0.28
5. Shading Coefficient: 0.33.
6. Solar Heat Gain Coefficient: 0.29.
7. Light to Solar Gain (LSG): 1.25.

D. Frosted Glazing:
1. Etched surface (inner face) of pane.
   a. Install pane on outer face of insulated units
2. Provide medium to heavy sandblast samples for Architect selection

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

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SECTION 08 90 00 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Fixed, extruded-aluminum louvers.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
   2. Division 8 Section “FRP Aluminum Hybrid Doors”.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Samples for Initial Selection: For units with factory-applied color finishes.

C. Samples for Verification: For each type of metal finish required.

D. Qualification Data: For professional engineer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.5 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2023) The 2022 Code of Regulations CCR, CFC, CMC, CPC, CEC Govern
   1. T Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2018 IBC, as Amended by CA
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
   5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
   6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)
   7. Title 24 CCR, Part 6 - 2022 California Energy Code
   8. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA)
   9. Title 24 CCR, Part 10 - 2022 California Existing Building Code
   10. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)
   11. Title 19 C.C.R., Public Safety, SFM Regulations.
   12. 2010 ADA Standards for Accessible Design
   13. Americans with Disabilities Act (ADA), Title II or Title III

B. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

C. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.2, "Structural Welding Code--Aluminum."

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of louvers and vents that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Louvers: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Greenheck. (***Basis of Design***)
   2. Airline Products Co.
   3. Airolite Company .
   4. Construction Specialties, Inc.
   5. Industrial Louvers, Inc.
   6. Or equal (Reference substitution requirements in Section 01 60 00)

B. Fire Rated Steel Door Louvers: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Anemostat (*Basis of Design*)
   2. Ceco Inc
   3. Activar, Inc
   4. Or equal (Reference substitution requirements in Section 01 60 00)

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26, alloy 319.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
   1. Use types and sizes to suit unit installation conditions.
   2. Use screws for exposed fasteners, unless otherwise indicated.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel, unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
   1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
   2. Exterior Corners: Prefabricated corner units with mitered and welded blades mitered blades with concealed close-fitting splices and with fully recessed semirecessed mullions at corners.

F. Provide subsills made of same material as louvers or extended sills for recessed louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:
1. Product: ILI 5" Deep Sight Proof Drainable Blade Model SP-537 by Industrial Louvers.
2. Sizes: As indicated on Drawings.
3. Frame and blade thickness to be .081" extruded aluminum 6063-T6 alloy.
4. Frame shall be designed to collect and drain water to exterior at sill by means of channels in the jambs.
5. Sill and jamb frame shall be continuously welded and caulked to prevent water penetration to interior wall construction.
6. Blades are attached by means of all welded (or mechanically fastened) assembly.
7. Louver to be supplied with 3.5" high sill pans with welded end dams.
8. Louvers shall bear the AMCA Certified Rating Seal for both air performance and Wind Driven Rain ratings.
9. Louvers shall have a minimum of 8.00 sq. ft. (50%) of free area on a 48" x 48" louver.
10. Louver manufacturer shall submit certified water penetration test data at a rainfall rate of 3 inches per hour with a wind directed at the louver face at a velocity of 29.1 mph.
11. Test data shall show the following results (on a 1m2 core area unit) maintaining a .99 effectiveness rating:
    a. Maximum intake core velocity = 2.46 m/s (484 fpm).
    b. Maximum free area velocity = 4.34 m/s (854 fpm).
    c. Intake pressure drop = 44.7 Pa (.180 in. wg).
    d. Intake capacity = 2.46 m3/s (5208 cfm).
12. Louver Screens: Provide framed removable screens for exterior louvers.
    a. Screens shall be insect screen type flattened expanded aluminum screen mounted in an extruded aluminum removable frame.
    b. Locate screens on inside face of louvers.
    c. Screen frames shall have welded corners and be secured to the louver frame with machine screws, at each corner and at 12" c.o. between.
13. Shop Finishing: Factory finish louvers and accessories with an organic coating.

a. Organic Coating: Clean and prime exposed aluminum surfaces and apply a Kynar 500/Hylar 5000 2-coat finish conforming to AAMA 605 in a standard color to be selected by Architect. Minimum dry film thickness shall be 1.2 mil.
b. Finish Protection: Provide finish protection as recommended by louver manufacturer.

2.5 FIRE RATED STEEL DOOR LOUVERS (interior doors)

A. Product: Fire Rated (165 degree) Fusible Link Louver Model # FLDL-W (UL) by Anemostat or equal
1. Sizes: As indicated on Drawings or example (12" H X 24" W).
2. Louver and frame finish to be factory baked enamel to match door color
3. Frame and blade thickness to be 18 GA" cold rolled steel.
4. Louver assembly shall be tested with UL mark for 60 min.
5. Frame corners shall be tight mitered, no visible welds and countersunk mounting holes.

2.6 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
1. Screen Location for Fixed Louvers: Interior face.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Re-wirable frames with a driven spline or insert for securing screen mesh.

D. Louver Screening for Aluminum Louvers: Provide all exterior building mechanical and equipment penetrations with a 1/2-inch-mesh, aluminum bird screen. Provide insect screens to areas that handle food, service equipment, or do not have filters to stop insects.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
      a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Vandal Protection: Louvers located in accessible areas shall use special vandal resistant hardware for installation.

D. Form closely fitted joints with exposed connections accurately located and secured.

E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
   1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 90 00

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following interior gypsum board:
   1. Type X (GWB).
   2. Classroom Buildings
   3. Construction DocumentsIII
   4. Sound Control Gypsum Board (GWB-STC)
   5. Abuse Resistant (GWB-VHI).
   6. Abuse and Water Resistant (GWB-WR).

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
   2. Division 9 Section "Ceramic Tile" for cementitious backer board installed as substrates for ceramic tile.
   3. Division 9 Section “Painting” for primers and finishes applied to gypsum board surfaces.

1.3 SUBMITTALS

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

B. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Finishes: Provide Level 4 and 5 of gypsum board finish indicated for use in exposed locations. 4 by 4 foot sample of each.
      a. Finishes: For each finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

A. Reference Standards:

1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA
4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)
7. Title 24 CCR, Part 6 - 2022 California Energy Code
8. Title 24 CCR. Part 8 - 2022 California Historical Building Code
9. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
10. Title 24 CCR, Part 10 - 2022 California Existing Building Code
11. Title 24 CCR, Part 11 - 2022 California Green Building Standards Code (Calgreen Code)

B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency acceptable to DSA.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each finish indicated.
      c. Each areas such as walls, ceilings, and soffits.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gypsum board that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Interior Gypsum Board: Subject to compliance with requirements, provide products by one of the following:
   1. USG Corporation.
   2. National Gypsum Company.
   3. G-P Gypsum.
   4. Or equal (Reference substitution requirements in Section 01 60 00)

B. Sound Control Wall Board: Subject to compliance with requirements, provide products by one of the following:

1. Pabco Corporation.
2. Certainteed
3. Gold Bond
4. Or equal (Reference substitution requirements in Section 01 60 00)

C. Steel Trim Accessories: Subject to compliance with requirements, provide products by one of the following:
1. Amico.
2. Or equal (Reference substitution requirements in Section 01 60 00)
3. Steel Trim Accessories:

2.2 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X:
1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Water-Resistant Gypsum Backing Board: ASTM C 630 or ASTM C 1396.
1. Core: 5/8 inch, Type X.
2. Use: Toilet rooms and janitor's closets walls with painted finish.
3. Products:
   a. SHEETROCK Brand Water-Resistant Firecode Core Gypsum Panels by USG.
   b. Gold Bond Brand Moisture-Resistant Fire Resistant Gypsum Board by National Gypsum.
4. Or equal (Reference substitution requirements in Section 01 60 00)
   a. Steel Trim Accessories:

5. When Water-Resistant Gypsum Backing Boards are not available (gradual phasing out by manufacturers), provide Moisture- and Mold-Resistant Type X: With moisture - and mold-resistant core and surfaces.
   a. SHEETROCK Brand HUMITEK by USG.
   b. XP Wallboard by National Gypsum.
   c. DensArmor Interior Guard by G-P.
6. Or equal (Reference substitution requirements in Section 01 60 00)

a. Steel Trim Accessories:

D. Sound Control Gypsum Board
1. Manufactured to ASTM C1278 material standards.
2. Core: 5/8 inch, Type X.
3. Products:
a. Sound Break XP by Goldbond (Basis of Design)
b. Quietrock by Pabco.
c. Silent FX by Certainteed
4. Type and Thickness: Type X, 5/8 inch thick.

E. Impact Resistant Type: ASTM C1278 and ASTM C1629.
1. Core: 5/8 inch, Type X.
2. High-density paperless gypsum and cellulose wall panels with long edges.
3. Products:
a. FIBEROCK Brand VHI panels by USG.
b. Hi-Impact XP Wallboard by National Gypsum.
4. Or equal (Reference substitution requirements in Section 01 60 00)
a. Steel Trim Accessories:

F. Fiber-Reinforced Gypsum Board:
1. Manufactured to ASTM C1278 material standards.
2. Product: Fiberock Brand Aqua-Tough Panel by USG Corp. (Basis of Design)
3. Type and Thickness: Type X, 5/8 inch thick.
4. Description: Abuse resistant, water resistant, mold resistant, fire resistant, environmentally friendly (made from 95% recycled materials), smooth paintable surface.
5. Stud Spacing: Up to 24 inches on center on ceilings with Type X, 5/8 inch thick.
6. Use:
a. On ceilings over sheet waterproofing and with epoxy painted finish.
b. Toilet rooms and janitor's closets ceilings with epoxy painted finish.

2.4 TRIM ACCESSORIES

A. Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Casing bead; J-shaped; exposed long flange receives joint compound

g. Expansion (control) joint.
h. Curved-Edge Cornerbead: With notched or flexible flanges.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Acoustical Sealant: Sheetrock Acoustical Sealant by USG or equal.

D. Thermal and Acoustical Insulation: As specified in Division 7 Section "Building Insulation."

E. Gypsum Board Adhesives: High performance latex-based construction adhesive designed for gypsum board applications.
1. Green Series SW-325 Shear & Drywall Adhesive by OSI.
2. Drywall Adhesive GDWA by Grabberman.
3. Or equal (Reference substitution requirements in Section 01 60 00)
4. Steel Trim Accessories:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Notify Inspector of Record 48 hrs in advance of when coats of mud are being applied to confirm correct coats.

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension

lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. L-Bead: Use where indicated.
   4. U-Bead: Use at exposed panel edges.
   5. Casing Bead: Provide at edges of Gyp. Bd. where material changes occurs or when gyp. bd. butt to windows and/or doors to provide a straight and level finished edge.
   6. Expansion (control) joint.
   7. Curved-Edge Cornerbead: Use at curved openings.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Comply with GA 214 for Level definitions.
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for ceramic tile or acoustical tile.
   3. Level 3: Where indicated on Drawings.
   4. Level 4: At panel surfaces that will be exposed to view with flat paint finish.
      a. Primer and its application to surfaces are specified in other Division 9 Sections.
   5. Level 5: At panel surfaces that will be exposed to view with non-flat paint finish.

a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 25 00

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SECTION 09 30 13 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Ceramic floor and wall tile (CFT, CT).
   2. Porcelain Tile (PT)
   3. Tile trims (CTB).
   4. Grout (GRT).
   5. Solid polymer thresholds installed as part of tile installations.
   6. Waterproof membrane for tile installations.
   7. Cementitious backer units installed as part of tile installations.

B. Related Sections include the following:
   1. Division 9 Section "Gypsum Board" for moisture resistant gypsum board.
   2. Division 9 Section “Finish Schedule” for color selection.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

1.4 SYSTEM DESCRIPTION

A. Ground and Floor Surfaces:
   1. Minimum 0.6 static coefficient of friction under wet conditions per ADAAG A4.5.1. and ASTM D2047.

1.5 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.
   2. Step Treads: Minimum 0.6.
   3. Ramp Surfaces: Minimum 0.8.

1.6 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
   1. Propose locations of expansion, contraction, control, and isolation joints if not indicated on Drawings.

C. Installation Method: Show TCA installation method number for each tiled area in tabulated form.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Qualification Data: For Installer.

G. Material Test Reports: For each tile-setting and -grouting product.

1.7 QUALITY ASSURANCE

A. Reference Standards:
   1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2018 IBC, as Amended by CA
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
   5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
   6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)

7. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
8. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)
9. Americans with Disabilities Act (ADA), Title II or Title III.

B. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ceramic tile and accessories that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer's Warranty: 1 year.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ceramic Tile: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Daltile; Div. Dal-Tile International Corp**.**
   2. American Olean
   3. Or approved equal, (See 01 60 00 for substitution requirement)

B. Porcelain Tile: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Daltile; Div. Dal-Tile International Corp.
   2. American Olean
   3. Or approved equal, (See 01 60 00 for substitution requirement)

C. Solid-Polymer Thresholds: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Avonite, Inc.
   2. DuPont Polymers.
   3. Formica Corporation.
   4. Nevamar; International Paper; Decorative Products Division.
   5. Or equal (Reference substitution requirements in Section 01 60 00).

D. Setting, Grouting, and Waterproofing Materials: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Custom Building Products.
   2. LATICRETE International Inc.
   3. MAPEI Corporation.
   4. Or equal (Reference substitution requirements in Section 01 60 00).

E. Sheet Waterproofing for Tile Installation: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Schluter; KERDI. (Basis of Design)
   2. Noble Company (The); Nobleseal TS
   3. Or equal (Reference substitution requirements in Section 01 60 00).

F. Cementitious Backer Board: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. USG Corporation; DUROCK Cement Board.
   2. National Gypsum Company; PermaBase.
   3. C-Cure; C-Cure Board 990.
   4. Custom Building Products; Wonderboard.
   5. Or equal (Reference substitution requirements in Section 01 60 00).

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. Colors: As scheduled on the Finish Schedule shown in the plans.
   2. Floor colors:
      a. TBD
   3. Walls
      a. TBD

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

A. As scheduled on the "Finish Schedule" noted in the plans.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

B. Solid Polymer Thresholds: Made from homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without precoated finish.

2.5 SHEET WATERPROOFING FOR TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10.

B. Thin (1/32 inch) bonded, load bearing sheet membrane for waterproofing. Alloy made from Chlorinated Polyethylene (CPE) with nonwoven fabric laminated to both sides.
   1. System Performance: 1-14 "Extra Heavy Service" cycles per ASTM C627.
   2. Hardness: 82 shore A per ASTM D2240.
   3. Tensile Strength: 1600 psi per ASTM D412 Die C.
   4. Elongation: 44% per ASTM D412 Die C.
   5. Tear Strength: 400 psi per ASTM D624 Die C.
   6. Shear Strength: Pass per ANSI A118.10-1993.
   7. Shear Strength - Water Immersion: Pass per ANSI A118.10-1993.
   8. Fungus & microorganism Resistance: Pass per ANSI A118.10-1993.
   9. Seam Strength: Pass per ANSI A118.10-1993.
   10. Waterproofness: Pass per ANSI A118.10-1993.

2.6 FLUID-APPLIED WATERPROOFING AND CRACK SUPPRESION FOR TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10.

B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.

2.7 SETTING AND GROUTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A and as specified below:

1. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
2. Latex Additive: Manufacturer's standard water emulsion.
3. Products:
   a. MAPEI, Mapecem 102, Powder, MAPEI, Planicrete AC (Liquid).
   b. 3701 (liquid) Additive with 226 (powder) by Laticrete.
   c. Custom Building Products: Acrylic Mortar Admix
   d. Or equal.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
   a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
2. Products:
   a. MAPEI: Ultraflex 2, Walls: MAPEI Ultralite.
   b. 254 Platinum by Laticrete.
   c. Or equal.

C. Chemical-Resistant, Water-Cleanable, Grouting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F and 212 deg F, respectively, and certified by manufacturer for intended use.
2. Products:
   a. Custom Building Products: 100% Solids Epoxy Grout. (Basis of Design)
   b. MAPEI: Kerapoxy IEG.
   c. SpectraLock Pro by Laticrete.
   d. Or equal.

2.8 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.9 CEMENTITIOUS BACKER UNITS

A. Properties:
   1. Aggregated portland cement board with coated glass-mesh reinforcement scrim.
   2. Comply with ANSI A118.9.
   3. Pass ASTM E136 for non-combustibility.
   4. Thickness: As indicated on Drawings.
   5. Lengths: Maximum lengths available to minimize end-to-end butt joints.

2.10 MOISTURE AND MOLD-RESISTANT GYPSUM BOARD

A. Comply with requirements of Division 9 Section “Gypsum Board”.

B. Substrates for painted surfaces in toilet rooms. Do not use as substrate for tile application.

2.11 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, stainless steel; ASTM A 666, 300 Series exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

2.12 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
      a. Sub-floor and Vertical Surfaces: 1/4 inch in 10 feet.
   2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
   3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
   1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.

H. Grout tile to comply with requirements of the following tile installation standards:
   1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

C. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: 1/16 inch unless specified otherwise.

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

D. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.7 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch.
   2. Glazed Wall Tile: 1/16 inch.

3.8 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.9 FLOOR TILE INSTALLATION, TCA ASSEMBLY

A. Tile Installation: Interior floor installation on concrete; cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A.
   1. Grout: Chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.

3.10 WALL TILE INSTALLATION, TCA ASSEMBLY

A. Tile Installation: Interior wall installation over waterproof membrane, cementitious backer units; thin-set mortar; TCA W244F-07 and ANSI A108.5.
   1. Grout: Chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.

END OF SECTION 09 30 13

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings
   1. 2 X 4 Direct Attached Acoustic Panels (C3)
   2. 2 X 4 Lay-in Acoustic Panels (C4)

B. Related Sections include the following:
   1. Division 7 Section “Joint Sealants” for acoustical sealant requirements.
   2. Division 9 Section “Finish Schedule” for color selection.

1.3 REFERENCES

A. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

B. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

D. ASTM C641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

E. ASTM E580 - Application of Ceiling Suspension Systems from Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint. (Reference Section 5)

F. ASTM E1264 - Classification of Acoustical Ceiling Products.

G. CCR - California Code of Regulations, Title 24, Part 2, Chapter 25A.

H. DSA - Division of the State Architect.

I. CBC - California Building Code.

J. UL - Underwriters' Laboratories Building Material Directory.

1.4 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.5 SYSTEM DESCRIPTION

A. DSA Interpretation of Regulations (IR) Document Metal Suspension Systems for Lay In Panel Ceilings (IR25-2.13) references CBC, Section 2501A.5:

1. Applies to ceiling systems whose total weight, including air conditioning grilles and light fixtures, does not exceed four (4) psf. Heavier systems and those supporting lateral loads from partitions will require special design details.
2. 12 ga. minimum hanger wires may be used for up to and including 4'-0" x 4'-0" grid spacing and shall be attached to main runners.
3. Provide 12 ga. hanger wires at the ends of all main and cross runners within eight (8) inches of the support or within one-fourth (1/4) of the length of the end tee, whichever is least, for the perimeter of the ceiling area. Perimeter wires are not required when the length of the end "T" is eight (8) inches or less. End connections for runners which are designed and detailed to resist the applied vertical and horizontal forces may be used in lieu of the 12 ga. Hanger wires, subject to Division of the State Architect (DSA) review and approval.
4. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb are to have counter sloping wires.
5. Ceiling grid members may be attached to not more than two (2) adjacent walls per ASTM E580 Section 5.2.3. Ceiling grid members shall be at least 3/4 inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 3/4 inch clear of wall.

6. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut/ stabilizer or a 16 ga. wire with a positive mechanical connection to the runner may be used. Where the perpendicular distance from the wall to the first parallel runner is eight (8) inch or less, this metal strut/ stabilizer or a 16 ga. wire is not required.
7. Provide bracing assemblies consisting of a compression strut and four 12 ga. Splayed bracing wires oriented 90 degrees from each other at the following spacing:
    a. For school buildings, place bracing assemblies at a spacing not more than 12 by 12 feet on center.
    b. For Essential Services Buildings, place bracing assemblies not more than 8 by 12 feet on center.
    c. Provide bracing assemblies at locations not more than 1/2 the spacings given above, from each perimeter wall and at the edge of vertical ceiling offsets. The slope of these wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut. Splices in bracing wires are not to be permitted without special DSA approval.
    d. Lateral force bracing *may* be omitted for all values of S_{SD} suspended acoustical ceiling systems with a ceiling area less than 144 square feet or less, , surrounded by walls which connect directly to the structure above, do not require bracing assemblies when attached to two adjacent walls.
8. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. (NOTE: Hanger wire twists between 1-1/2" and 3" are assumed to develop no more than 50% of allowable load for the wire.) Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.
    a. Wire turns made by machine where both strands have been deformed or bent in wrapping can waive the 1-1/2-inch requirement, but the number of turns should be maintained, and be as tight as possible.
9. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4-inch nominal diameter, to hanger wires using connectors acceptable to DSA.
10. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 out of 10 must be field tested for 200 lbs. in tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 must be field tested for 440 lbs. in tension. Shot-in anchors in concrete

are not permitted for bracing wires. If any shot-in or drilled-in anchor fails, see CBC, Section 1923A.3.5.

a. Post-installed anchors (e.g. expansion anchors, screw anchors and power actuated fasteners) shall have a current Evaluation Report acceptable to DSA in accordance with DSA IR-A-5.
b. Drilled-in or shot-in anchors require special DSA approval when used in pre-stressed concrete. *Processing costs and design fees required to process changes will be back-charged to the Contractor thru a deductive change order.*

11. Attach all light fixtures and ceiling mounted air terminals or services, to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures. A minimum of two (2) screws or approved fasteners are required.
12. Flush, surface-mounted or recessed light fixtures and air terminals or services, weighing less than 56 lbs., may be supported directly on the runners of a heavy duty grid system but, in addition, they must have a minimum of two 12 ga. slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. All 4 x 4 feet light fixtures must have slack safety wires at each corner.
    a. All flush or recessed light fixtures and air terminals or services weighing 56 lbs. or more must be independently supported by not less than four (4) taut 12 ga. wires each attached to the fixture and to the structure above regardless of the type of ceiling grid system used.
    b. The 4 taut 12 ga. Wires including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
    c. Light fixtures weighing 10#'s or less shall have a minimum of one (1) #12 ga slack safety wire connected from the fixture to the structure above.
13. All fixtures and air terminals or services supported on intermediate duty grid systems must be independently supported by not less than 4 taut 12 ga. wires each attached to the fixture or terminal, and to the structure above.
14. Support surface mounted light fixtures by at least two positive devices which surround the mail ceiling runner and which are each supported from the structure above by a 12 ga. wire. Spring clips or clamps that connect only to the runner are not acceptable.
    a. Provide additional supports when light fixtures are 8'-0" or longer.
15. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 4 times the weight of the fixture. A bracing assembly per Figure 1, is required where the pendant hanger penetrates the ceiling. Special details are required to attach the pendant hanger to the bracing assembly to transmit horizontal forces.
16. Required notes on construction documents:

a. Classification of ceiling grid is heavy duty.
b. Manufacturer's catalog number - main runner.
    i. DX-26 (USG).
    ii. 7301 (Armstrong).
c. Manufacturer's catalog number - cross runner.
    i. DX424 or DX216 (USG).
    ii. XL7341 4 ft cross tee and XL7328 2 ft cross tee (Armstrong).
d. Manufacturer's catalog number of detail for runner splice.
    i. Integral system (USG).
    ii. Same as main runner, 7301. Mains connect together for compression/tension strength (Armstrong).

17. Additional Requirements for Metal Panels. Metal panels and panels weighing more than 1/2 psf, other than acoustical tile, are to be positively attached to the ceiling suspension runners.
18. Suspended Acoustical Ceilings below Gypsum Board Ceilings. Where gypsum board or other ceiling finishes are attached to the framing, special details will be required for the vertical hanger wire and lateral bracing wire support connections to the framing.
19. List of DSA Product Approvals for Suspended Acoustical Ceiling System:
    a. PA-026: Chicago Metallic Suspended Ceiling System.
    b. PA-030: USG Interior (Donn) Suspended Ceiling Grid Systems.
    c. PA-041: Armstrong World Industries Suspended Ceiling System. (Basis of Design)
20. Expansion joints and seismic separations joints:
    a. Expansion joints shall be provided in the ceiling at intersections of corridors and a junction of corridors and lobbies and similar areas.
    b. For ceilings exceeding 2,500 sf, a seismic separation joint shall be provided to divide ceiling areas not to exceed 2,500sf in accordance with ASTM E580, Section 5.2.9.

1.6 SUBMITTALS

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

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
    1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
    2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch-long Samples of each type, finish, and color.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

E. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.

F. Maintenance Data: For finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Reference Standards:
1. Title 24 CCR, 2022 Building Standards Administrative Code, Part 1, CBSC.
2. Title 24 CCR, 2022 California Building Code (CBC), Part 2, CBSC
3. Title 24 CCR, 2022 California Electrical Code (CEC), Part 3, CBSC
4. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
5. Title 24 CCR, 2022 California Energy Code, Part 6, CBSC.
6. Title 24 CCR, 2022 California Fire Code, Part 9, (CFC) (2018 IFC, as Amended by CA.
7. Title 24 CCR, California referenced Standards, Part 12 CBSC.
8. Title 19 C.C.R., Public Safety, SFM Regulations.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
a. Smoke-Developed Index: 450 or less.
b. Flame-Spread Classification: CBC 802.2 and Table 8-A.
i. Flame-Spread Rating: Class 1 (0-25).

D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
1. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

E. Installer: Company with five years minimum documented experience, approved by manufacturer.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical panel ceilings that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
   2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      a. Warranty Period: 1 year.

B. Acoustic panels:
   a. Warranty Period: Per manufacturer warranty

C. Installer's Warranty: 1 year.

1.12 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
   3. Hold-Down Clips: Equal to 3.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustical Panels: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Armstrong World Industries, Inc.
   2. BPB Celotex.
   3. Chicago Metallic Corporation
   4. USG Interiors, Inc.
   5. Substitutions: Under provisions of Section 01 60 00.

B. Suspension Systems: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Prelude XL Armstrong World Industries, Inc.
      a. 15/16" Prelude XL Grid
   2. Chicago Metallic Suspended Ceiling System.
   3. USG Interior (Donn) Suspended Ceiling Grid Systems.
   4. Armstrong World Industries Suspended Ceiling System. (Basis of Design)
   5. Substitutions: Under provisions of Section 01 60 00

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as

designated by types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

2.3 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Acoustical Panels: Mineral fiber, ASTM E 1264 Type III, with the following characteristics:
   1. C3 Invisacoustics by Armstrong World Industries.
      a. Type: Model 1914 – 24 x 48 as indicated on Drawings.
      b. Texture: Smooth
      c. Thickness: Mineral Fiber
      d. Average Light Reflectance: 85 percent, determined as specified in ASTM E 1477.
      e. NRC Range: 0.75
      f. Edge: Square (all sides)
      g. Surface Color: White.
      h. Recycled Content: greater than 50%.
      i. Class A: Flame spread 25 or under (UL Labeled) per ASTM E.
      j. Direct attach
   2. C4 "Ultima" by Armstrong World Industries.
      a. Type: Model 1914 – 24 x 48 as indicated on Drawings.
      b. Texture: Fine.
      c. Thickness: 15/16 inches. Mineral Fiber
      d. Average Light Reflectance: 85 percent, determined as specified in ASTM E 1477.
      e. NRC Range: 0.60, determined as specified in ASTM C 1414
      f. Edge: Beveled Tegular edge.
      g. Surface Color: White.
      h. Recycled Content: 32 to 53%.
      i. Class A: Flame spread 25 or under (UL Labeled) per ASTM E 1264.
      j. Suspension Grid Face: 15/16 inch.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, carbon steel.
   2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 12 gauge (0.106") diameter, soft temper. Minimum tensile strength = 70 ksi. Maximum allowable (ASD) tension load for wire meeting this specification is 350#'s.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

J. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

K. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Exposed Steel Suspension System: Formed galvanized steel, commercial quality cold rolled; heavy-duty.
   1. Product: 7301 Prelude XL by Armstrong.
      1. Profile: Tee; 15/16 inch wide face.
      2. Construction: Double web.
      3. Structural Classification: ASTM C 635 Heavy-Duty.
      4. Finish: Factory painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2.7 ACOUSTICAL SEALANT

A. Comply with requirement of Division 7 “Joint Sealants”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with UBC Standard 25-2 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   5. Do not attach hangers to steel deck tabs.
   6. Space hangers not more than 48 inches oc. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
   7. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install 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.
1. Arrange directionally patterned acoustical panels as follows:
    1. As indicated on reflected ceiling plans.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

E. Product Schedule: For resilient base and accessory products, see drawing schedule [B1]

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F more than 95 deg F, in spaces to receive resilient products during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Floor Score Compliance: Resilient base shall comply with requirements of Floor Score certification.

B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 THERMOSET-RUBBER BASE [B1]

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following]:
   1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   2. Flexco.
   3. Roppe Corporation, USA.
   4. Or equal.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
   1. Style and Location:
      a. Style A, Straight/ Topset: 4" Provide in areas with carpet, provide in coils per manufacturer' standard length
      b. Style B, Cove: 4" Provide in areas with resilient flooring, provide in coils per manufacturer' standard length

C. Height: 4 inches

D. Lengths: Coils in manufacturer's standard length

E. Outside Corners: Job formed

F. Inside Corners: Job formed

G. Colors: As selected by Architect from full range of industry colors

2.3 THERMOPLASTIC-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AB; American Biltrite.
   2. Allstate Rubber Corp.
   3. Armstrong World Industries, Inc.
   4. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   5. Or equal.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

   1. Group: Solid
   2. Style and Location:
      a. Style A, Straight/ Topset: 4" Provide in areas with carpet, provide in coils per manufacturer' standard length
      b. Style B, Cove: 4" Provide in areas with resilient flooring, provide in coils per manufacturer' standard length

C. Thickness: 0.125 inch

D. Height: 4 inches

Lengths: Coils in manufacturer's standard length

E. Outside Corners: Job formed

F. Inside Corners: Job formed

G. Colors: As selected by Architect from full range of industry colors

2.4 VINYL BASE

A. Manufacturers: Subject to compliance with requirements, provide products by the following
   1. *Armstrong World Industries, Inc.*
   2. *Burke Mercer Flooring Products, Division of Burke Industries Inc.*
   3. *Johnsonite; A Tarkett Company.*
   4. Or equal.

B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
   1. Group: solid
   2. Style and Location:
      a. Style A, Straight/ topset: Provide in areas with carpet
      b. Style B, Cove: Provide in areas with resilient flooring

C. Minimum Thickness: 0.125 inch

D. Height: 4 inches

E. Lengths: Coils in manufacturer's standard length

F. Outside Corners: Job formed

G. Inside Corners: Job formed

H. Colors and Patterns: As selected by Architect from full range of industry colors

2.5 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work *include, but are not limited to, the following:*
1. *Roppe Corporation, USA.*
2. *VPI, LLC, Floor Products Division.*
3. Or equal. See Section 01 60 00 for substitution requirements

B. Description: Rubber cap for cove carpet, cap for cove resilient flooring, carpet edge for glue-down applications, nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, and transition strips

C. Profile and Dimensions: As indicated

D. Locations: Provide rubber molding accessories in areas indicated on the plans

E. Colors and Patterns: As selected by Architect from full range of Manufacturers standard colors

2.6 VINYL MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. *Armstrong World Industries, Inc.*
2. *Burke Mercer Flooring Products, Division of Burke Industries Inc.*
3. *Flexco.*
4. *Johnsonite; A Tarkett Company.*
5. *Roppe Corporation, USA.*
6. Or equal. See Section 01 60 00 for substitution requirements

B. Description: Vinyl cap for cove carpet, cap for cove resilient flooring, carpet bar for tackless installations, carpet edge for glue-down applications, nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, transition strips

C. Profile and Dimensions: See drawings

D. Locations: See Drawings

E. Colors and Patterns: As selected by Architect from full range of industry colors

2.7 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.)

1. Product: Subject to compliance with requirements, provide named or comparable product by one of the following:
   a. Mapei
   b. TEC
   c. Ardex
2. Product: MAPEI Self Leveler Plus Indoor Self-Leveling Underlayment
   a. Primer T by Mapei
   b. Eco Prim Grip primer by Mapei
3. Product: TEC Easy Level Premium Self leveling Underlayment 323).
   a. Primer: TEC Multi-purpose primer
4. ARDEX K-15 Self-Leveling Concrete Topping
   a. Primer: Ardex P-51
5. Or approved Equal see Section 01 60 00 for substitution requirements.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Base Adhesive Product: Subject to compliance with requirements, provide by one of the following:
   a. Armstrong Wall base adhesive: Part #S-725
   b. TEC® Premium Cove Base Adhesive (TA-714), premium adhesive for the installation of rubber, vinyl, or Thermoplastic Rubber (TPR).
   c. Or approved equal, See Section 01 60 00 for substitution requirements

2. Adhesives shall have a VOC content of 50 g/L or less

3. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

      a. Form without producing discoloration (whitening) at bends.

   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

      a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.

3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This section deals with resilient flooring found in the drawings and schedules of the contract that meet the requirements of this section.

1.2 RELATED SECTIONS

A. Section 3 – Cement: not covered in this section.

B. Section 6 – Wood and plastic: not covered in this section.

C. Section 7 – Thermal and humidity protection: not covered in this section.

D. Section 9 – Other sections containing information related to floor finishes: not covered in this section.

1.3 REFERENCES (INDUSTRY STANDARDS)

A. ASTM F 710: Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. ASTM E 648: Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

C. ASTM E 662: Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

D. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. ASTM F 2170: Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.

1.4 ITEMS TO DELIVER

A. Provide the product’s Technical Specifications data sheet as well as all installation and maintenance instructions.

B. When required, supply floor drawings and installation plans.

C. Supply a set of samples measuring at least 3 in. (7.5 cm) by 6 in. (15 cm) of the complete range of colors and finishes chosen for the project.

D. When required, provide Manufacturer's attestation, certified by an independent laboratory, confirming that the flooring complies with the fire standards of the following tests:
   1. ASTM E 648; Critical Radiant Flux: 0.45 watts/cm2 or more.
   2. ASTM E 662; Smoke Density: 450 or less.

E. Provide Manufacturer's Warranty Certificate.

1.5 QUALITY ASSURANCE

A. Have flooring installed by an installer qualified in the installation of resilient flooring.

B. In accordance with the installation instructions, use all accessories recommended by Manufacturer when installing its flooring.

C. Follow the instructions specified in the most recent version of Manufacturer's installation instructions.

1.6 DELIVERY, HANDLING, STORAGE

A. Deliver the flooring to the installation site in Shaw Contract's original packaging. Indicate the project name and handling instructions on the outside of the boxes.

B. Advise the carrier of any damaged material and indicate it on the packing slip.

C. Store the flooring inside, sheltered from extreme hot or cold temperatures. Place the material on a smooth level floor or where there is uniform solid support in a clean, dry, well-ventilated area. The long-term storage temperature must be maintained between 65°F (18°C) and 85°F (29°C). Protect adhesive and flooring material from freezing, extreme heat and direct sun exposure.

D. Acclimate the subfloor, all flooring material and adhesive for 48 hours before, during and after the installation by maintaining the room temperature between 65°F (18°C) and 85°F (29°C). The pallets should be unstacked 24 hours prior to use.

E. Afterwards, maintain the room temperature between 65°F (18°C) and 85°F (29°C). Protect the material from direct sources of heat such as air vents and other types of heaters.

F. Install the flooring after all other finishing work, including painting, has been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Shaw Contract, 160 S. Industrial Blvd, Calhoun GA 30701 Telephone 800.241.4494.
Website: Commercial Flooring Solutions | ShawContract
Contact:

B. Substitutions or Equals:
1. Substitutions are allowed only if they meet the following criteria:
a. Acceptance of alternate product(s) that are accepted as equals must be approved by parties (including, but not limited to) that have material interest in the specifications including: Designer, Architect, End-User, and Flooring Contractor.

2.2 MATERIALS

A. DETAILED PRODUCT CONSTRUCTION SPECIFICATIONS

Style Name	Joy Squared – 0993V
Collection	Joy Squared
Product Type	Direct Glue LVT
Overall Thickness	2.5 mm (0.098”)
Wear Layer	20 mil (0.02 mm)
Finish	ExoGuard+®
Size	24” x 24” or 12” x 24”
Square Feet Per Carton	68 sf/ctn
Pounds Per Carton	57.79 lbs/ctn
Installation Method	Direct Glue

Recommended Installation Methods

Brick or Ashlar

Sustainability

Floor Score Floor Score Certified

Country of Origin USA

Environmental Product Declaration 3rd Party Certified in Accordance with ISO 14025, EN 15804, & ISO 21930:2017

Class III, Type B

B. Refer to the product's Technical Specifications data sheet for detailed specifications.

C. Choose from any of ShawContract's complete line of 24 colors

D. All specifications are subject to normal manufacturing tolerances

2.3 ADHESIVE

A. Shaw Contract requires the use of the following adhesives to maintain the product warranty:
   1. S150-95 Resilient Tile Spray
   2. 4200 Resilient Tile 4 Gallon
   3. 4151 Multi-Use Premium 4 Gallon

2.4 OTHER MATERIAL

A. Subfloor repairs: use a good-quality Portland cement-based compound modified with latex that has a minimal resistance to compression of 3500 lbs/sq. in. (246 kg/cm2). to fill, smooth and/or level subfloor imperfections.

B. Self-levelling underlayment: use a Portland cement-based self-levelling underlayment modified with a polymer that has a minimal resistance to compression of 3500 lbs/sq. in. (246 kg/cm2).

PART 3 - EXECUTION

3.1 SITE INSPECTION

A. Examine the subfloor before installation to ensure that the surface is clean, dry, smooth, structurally sound and free from foreign substances that may adversely affect adhesion or cause discoloration. Furthermore, ensure that the subfloor is free of paint, varnish, adhesive, oil, grease, solvent and other foreign substances, including treatment compounds, sealers and curing compounds that may adversely affect adhesion or alter the appearance or durability of the resilient flooring.

B. Verify the surface to ensure there is no powder, scaling or mold. If found remove with a mechanical sander and level with a good-quality Portland cement-based self-levelling underlayment modified with a polymer that has a minimal resistance to compression of 3500 lbs/sq. in. (246 kg/cm2).

C. Slabs that have been either using a curing agent or a sealer will have to be treated to ensure that the adhesion has not been impaired.

D. Do not install on cement slabs that have been subjected to adhesive chemical abatement unless an approved remediation system was used afterwards.

E. Report and rectify all unsatisfactory conditions. Do not start flooring installation until all rectifications have been completed.

3.2 SUBFLOOR PREPARATION

A. Level all rough surfaces and fill cracks and marks with a Portland cement-based patching compound modified with latex.

B. Mechanically remove all surface contaminants such as paint, oil, grease, varnish, adhesive as well as various other products such as treatment compounds.

C. Measure the humidity and pH levels in the cement in compliance with the following standards before installation:
   1. ASTM F 2170, Relative Humidity (RH) test using in situ probes.
   2. ASTM F 710, pH levels (test procedure 5.3.1).
   3. The ASTM test frequency recommendation is 3 measures for the first 1,000 sq. ft. (92.9 sq. m) and one measure for each additional 1,000 sq. ft. (92.9 sq. m).

D. Ensure Moisture, Relative Humidity and pH tests have all been conducted and measurements meet manufacturer’s recommendations.

E. In case of doubt, test the adhesion on the cement subfloor or other surface that will be covered by the flooring. Do the test using the specified flooring and recommended adhesive.

3.3 RESILIENT FLOORING INSTALLATION

A. Install the flooring according to the latest version of Shaw Contract's installation instructions. Use the tools, adhesives, trowel types and procedures recommended in the instructions.

B. Acclimate the subfloor, all flooring material and adhesive for 48 hours before, during and after the installation by maintaining the room temperature between 65°F (18°C) and 85°F (29°C). Afterwards, maintain the temperature between 65°F (18°C) and 85°F (29°C).

3.4 CLEANING AND PROTECTION

A. Remove all excess adhesive immediately after installation as recommended in Shaw Contract's installation instructions.

B. Before allowing traffic after installation, consult and follow the recommendations in Shaw Contract's installation instructions.

C. Following installation and cleanup, if the work of all other trades has not yet been completed, protect the flooring by laying sheets of non-staining brown Kraft paper and then a layer of plywood sheets (rolls of non-staining heavy cardboard material could also be used for protection).

D. Follow the instructions in ShawContract's Maintenance Instructions when performing initial and regular maintenance procedures.

E. Please note that technical website documents prevail.

END OF SECTION 09 65 19

SECTION 09 67 00 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.
   1. Medium Duty.

B. Divider strips and accessories.

1.02 RELATED REQUIREMENTS

A. Pertinent sections specifying Concrete Floor Preparation and Concrete Floor Moisture Content.

1.03 REFERENCE STANDARDS

A. ASTM C 307 - Standard Test Method for Tensile Strength of Chemical Resistant Mortar, Grouts, and Monolithic Surfacings.

B. ASTM C 413 - Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

C. ASTM C579 - Standard Test Method for Compressive Strength of Chemical Resistant Mortar, Grouts, Monolithic Surfacings and Polymer Concretes.

D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

E. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

F. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine, 2004.

G. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact), 2010.

H. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

I. MIL-PRF-24613A, Performance Specification: Deck Covering Materials, Interior, Cosmetic Polymeric (03 Nov 2007).

1.04 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available . Demonstrate compliance with specified attributes.

C. VOC Submittals:
   1. Product Data - VOC Limits: For adhesives sealants, fillers and primers, documentation including printed statement of VOC contents.

D. Qualifications: For Manufacturer and Applicator. Demonstrate compliance with specified attributes.

E. by inch in size illustrating color and pattern for each floor material for each color specified.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Manufacturer’s representative shall be available to advise applicator on proper surface preparation and application techniques.

1.06 MOCK-UP

A. Following review of complete submittals, Provide complete mock-up, 6 feet long by 6 feet wide, illustrating finish color and texture.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 PROJECT CONDITIONS

A. Sequence cabinet base and wall finish installation prior to fluid flooring to enable installation of integral coved flooring base in a single operation.

B. Coordinate fluid flooring installation with size, location and installation of service utilities.

1.09 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:
1. Tera-Lite, Inc.; www.tera-lite.com
2. Dur-A-Flex.; www.dur-a-flex.com (Basis of Design)
3. Stonhard, www.stonhard.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. VOC Limits for adhesives sealants, fillers, coatings and primers.

B. Provide Fluid-Applied Flooring with specified adhesion to concrete floors at up to 100% Relative Humidity as measured by ASTM D 2170, in situ probe testing.

C. Fluid-Applied Troweled Flooring System, Medium Duty : Epoxy, polymer modified, water-dispersed cementitious, three component, nominal 3/16 inch thickness.
1. Products:
a. Tera-Lite; Tera-Gem III Decorative Quality (DQ) Troweled.
b. Substitutions: See Section 01 6000 - Product Requirements.
2. Components:
a. Epoxy Primer: Manufacturer's standard penetrating two-component type.
b. Base Coat: 1/8 inch thick; selected color, three component mortar consisting of epoxy resin, curing agent and finely graded aggregates.
c. Undercoat (Receiving Coat): 100% solids epoxy formulation, three component, free-flowing.

d. Top Coat: Epoxy, single component; UV resistant, 1/16 inch thick; clear color.
e. Non-slip Surfacing: Quartz Aggregate, manufacturer's standard integral color type, suitable for broadcast application, selected color blend. Install to produce Coefficient of Friction between 0.7 and 0.8

3. Performance Criteria:
a. Tensile Strength: 1,700 psi, when tested in accordance with ASTM D 307.
b. Compressive Strength: 10,000 psi, when tested in accordance with ASTM C 579.
c. Water Absorption: <0.1 percent, when tested in accordance with ASTM C 413 for 24 hr.
d. Mildew Resistance: No growth.
e. Impact Resistance: 60 in/lb; no cracking, chipping or delamination, when tested in accordance with ASTM D2794 or MILPRF24613.
f. Flammability: Self-Extinguishing (Class I) per ASTM E648.
g. Color: Selected from full range of available colors. Minimum of 7 colors in product line.
h. Coefficient of Friction, Installed: 0.60 minimum, wet, measured in accordance with ASTM D2047.

D. Topical Vapor Control Coating for Fluid Flooring: Cementitious, polymer-modified three component, nominal 1/16 - 1/ 8 inch thickness, compatible with fluid-applied flooring. Allow successful installation of fluid applied flooring over concrete of 100 % Relative Humidity as measured by ASTM D2170 in situ probe.
1. Primer: Manufacturer's standard penetrating type.
2. Base Coat: 1/8 inch thick; selected color, polymer-modified mortar consisting of liquid latex resin and finely graded aggregates.

2.03 ACCESSORIES

A. Divider Strips: Zinc, 1/8 inch thick, height to match flooring thickness, with anchoring features; color as selected.

B. Control Joint Strips: Match divider strips; 1/8 inch nominal width, 1/8 inch wide neoprene filler strip between side strips, with anchoring features, strip height to suit flooring thickness.

C. Base caps: Type recommended by manufacturer for conditions required.

D. Cant Strips: Molded of flooring resin material.

E. Primer: Type recommended by manufacturer for substrate and body coats indicated.

F. Patching and Fill Material: Resinous product of or approved by epoxy coating manufacturer and recommended by manufacturer for application indicated.

G. Sealant: manufacturer's recommended type, suitable for conditions required.

H. Cleaners: Heavy-duty industrial detergent, manufacturer's recommended type, suitable for conditions required.

I. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Cementitious Subfloors:
   1. Verify that substrates have been prepared and tested for moisture content and pH as specified in related sections.
   2. Verify preparation of substrate to specified flatness and levelness tolerances as specified in related sections.
   3. Verify substrate has been mechanically cleaned and surface profiled as specified in related sections.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

C. Verify that sub-floor surfaces are sloped to drain, free of ponding areas or conditions which would impair positive drainage when installation is complete. Flood-test with water to confirm free drainage.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Crack Repair: Repair concrete slab cracks as recommended, using materials recommended by the flooring manufacturer and included in their warranty. Quantity Allowance: One lineal foot of crack repair per square foot of floor installation.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface with positive drainage configuration. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Apply primer to surfaces required by flooring manufacturer.

E. Install topical vapor control coating for fluid flooring complete with primer and recommended accessories at all areas indicated to receive fluid-flooring.

3.03 INSTALLATION - STRIPS

A. Accurately saw cut substrate to install divider strips.

B. Install strips straight and level to locations indicated.

C. Install fillet strips at base of walls where flooring is to be extended up wall as base.

D. Install terminating cap strip at top of base; install "H" or "T" channel configurations as required to suit specific conditions where wall panel finishes abut base; attach securely to wall substrate.

3.04 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer, free from trowel marks, swirls, pooled glaze or imperfections. Completed mock-up shall serve as appearance and texture standard for completed work.

C. Apply first coat of clear sealer and broadcast aggregate to refusal and allow to cure as required by manufacturer. Sweep off excess aggregate and apply second seal coat to obtain specified thickness and surface finish textures matching approved mockups.

D. Finish to smooth level surface with positive drainage as indicated. No ponding or birdbaths, all surface water flows to drain.

E. Fillet and cove at vertical surfaces.

F. Install sealants at perimeter and transition conditions in accordance with manufacturer's standard details and installation recommendations.

3.05 FIELD QUALITY CONTROL

A. Following manufacturer's recommended curing period, and prior to installation of further work, flood completed floor with water in presence of Owner's Inspector to verify positive drainage.

B. Completed work shall exhibit positive drainage, free from ponding or "birdbaths", with uniform color and texture consistent with the granular character of the flooring material, free of pooled,"swirled", or glazed topcoat, with surface finish textures matching approved mockups.

C. Immediately remove and replace work not conforming to these requirements.

D. Adjust textures at no cost to Owner at locations where finish textures do not match approved mockups:
   1. Too Rough: Apply additional coats of glaze topcoat until texture is acceptable.

2. Too Smooth: Apply additional broadcast of aggregate and lock-in with additional glaze top coat until texture is acceptable.

3.06 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

3.07 SCHEDULE

A. Epoxy Floor Coating - Medium Duty: Total Assembly thickness 3/16 inch (188 mil) minimum.
   1. Surface Preparation - Concrete: SSPC-SP13 / NACE No. 6 Surface Preparation of Concrete, minimum concrete surface profile (CSP) 4-6 per ICRI Technical Guideline 03741, as recommended by Fluid Flooring Manufacturer.
   2. Repair cracks.
   3. Topical Vapor Control Coating: If floor substrate Relative Humidity is outside manufacturer's recommended range, apply Topical Vapor Control Coating to horizontal surfaces, over prime coats as recommended by Manufacturer.
   4. Primer: Apply prime coats to surfaces if recommended by Manufacturer.
   5. Mortar / Slurry Base Coat: 3/16 inch (188 mils) DFT.
   6. Color Finish / Topcoat: Color as selected; 8.0 to 12.0 mils DFT.
   7. Integral Color Aggregate Broadcast to Refusal.
   8. Clear Topcoat, minimum two: 8.0 to 12.0 mils DFT, total.

END OF SECTION 09 67 00

SECTION 09 68 13 – CARPET TILE

PART 1 – GENERAL

1.01 SUMMARY

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.02 SUBMITTALS

A. Shop Drawing: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Seam locations
   6. Pattern of installation.
   7. Pattern type, location, and direction.
   8. Installation method (monolithic, quarter turn, ashlar, brick random, interactive patterning).
   9. Type, color, and location of electrical insets and penetrations and borders.
   10. Type, color, and location of edge, transition, and other accessory strips.
   11. Transition details to other flooring materials.

B. Floor schedule using same room designations indicated on drawings.

C. Product Data: For each type of product

   1. Include manufacturer's written specifications and lab documents for any physical testing.
   2. Include installation recommendations for each type of substrate as specified in carpet manufacturer's installation guidelines and/or Carpet & Rug Institute Installation Standard, where applicable.
   3. Include carpet maintenance recommendations as outlined by the carpet manufacturer.
   4. Carpet Manufacturer shall also submit a plan for recycling the specified carpet at the end of the useful life of the carpet.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.

E. Manufacturer's Product Warranty.

F. Certifications: Manufacturer to submit copies of the following independent laboratory reports showing compliance with requirements per these methods outlined in Part 2 of this document. Submitted results shall represent average results for production goods of the specified style.
   1. ASTM E-648 Flooring Radiant Panel
   2. ASTM E-662: Smoke Density
   3. AATCC 134: Electrostatic Propensity
   4. ASTM D-3936: Delamination

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications

   1. Company specializing in manufacturing specified carpet with minimum 5 years documented experience.

   2. Upon request, manufacturer to provide representative to assist in project start-up and to inspect installation while in process and upon completion. Representative will notify designated contact if any installation instructions are not followed.

   3. Single Source Responsibility: Obtain each type of product from one source and by a single manufacturer.

B. Installer Qualifications

   1. Flooring contractor must be certified by the manufacturer prior to bid.
   2. An installer with a minimum of 5 years commercial carpet installation experience, and who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
   3. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.
   4. Certify payment of Prevailing Wage Rates to the installers.

   5. Flooring contractor possessing Contract for the product installation shall not sub-contract the labor without written approval of the Project Manager.

   6. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the manufacturer and JOB CONDITIONS herein.

   7. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

1.04 DELIVERY, STORAGE, & HANDLING

A. Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.

B. Store in a dry location, between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Store in pallet form as supplied by Manufacturer. Do not stack pallets.

C. Make stored materials available for inspection by the Owner's representative.

D. Store materials in area of installation for minimum period of 48 hours prior to installation.

1.05 PROJECT CONDITIONS

A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.

B. Please see Modular Installation & Floor Preparation Instructions for specific requirements for moisture vapor emission rate, ambient conditions, and other requirements.

C. All material used in sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.

D. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

E. Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.06 EXTRA MATERIALS

A. Provide additional 5% of each product for attic stock.

PART 2 - PRODUCTS

2.01 RECYCLED CONTENT

A. Product must contain a minimum of 45% recycled content by weight. This percentage is calculated by dividing the weight of recycled content in one square yard of finished product by the total weight of one square yard of finished product, and multiplying by

100. [(Recycle Content Weight) / (Total Product Weight) x 100].

B. Product must contain 28% post-consumer recycled content by weight from recycled post consumer carpet. This ensures that carpet is diverted from landfills for the production of the product and that virgin resource use in the product is reduced.

C. Recycled content must be certified by a neutral, independent, third party organization such as Scientific Certification Systems. Product must carry product label certifying overall recycled content (including post-industrial and post-consumer content). Report percentage of post-industrial and post-consumer recycled content as a percentage of total product weight.

D. Product must be available inclusive of 50% recycled content secondary backing.

1. Recycled content and post consumer content must not be subject to availability. Post industrial and post consumer recycled content of product installed must be the same as those required by Project requirements.
2. Also, Recycled content must be expressed as an exact percentage or a range. Statements such as "up to 60%" recycled content are not acceptable.
3. Manufacturer must fully comply with FTC Part 260 "Guides for the Use of Environmental Marketing Claims," with respect to advertising, labeling, product inserts, catalogs and sales presentations of all its flooring products submitted and sold.

2.02 PRODUCT RECYCLABILITY

A. Product must meet FTC guides for recyclability and Preference will be given to manufacturer's recycling 100 percent of reclaimed carpet tile back into carpet tile with recycled content

B. Recyclability of product installed must be the same as those required by Project requirements.

C. Carpet Disassembly and Recycling: Carpet capable of disassembly and recycling, with nylon being recycled into nylon and backing being recycled into backing.
D. Carpet product must meet guidelines of Presidential Executive Order 13101, and must meet the spirit of section 6002 of the Resource and Recovery Act (RCRA).

2.03 RECYCLING PROGRAM

A. Manufacturer must have a collection and recovery system for product and a fully established, currently operational recycling program at time of bid per FTC guides Section 260.7 (d).
    1. Manufacturer must be able to reclaim and recycle 100% of installed carpet. Like material as installed must be 100% recycled.
    2. Manufacturer must have written guarantee that 100% of the recovered vinyl backed carpet will be recycled and that no portion of the product will be landfilled or incinerated (including waste-to-energy).

2.04 NSF 140-2007 CERTIFICATION

A. Product must be certified at the Platinum level to ANSI standard NSF 140, the Sustainable Carpet Assessment Standard (SCAS). Product certification must be conducted by an independent, third party organization such as Scientific Certification Systems. Provide documentation.
B. Product must be Silver level Cradle to Cradle Certified™ v3.1. Cradle to Cradle Certified is a certification mark licensed by the Cradle-to-Cradle Products Innovation Institute.

2.05 PRODUCT WARRANTY

A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.

C. Chair pads are not required, but are recommended for optimum textural performance. Absent the use of chair pads, more intensive maintenance will be required for areas in direct contact with chair caster traffic, and some degree of appearance change is to be expected.

D. The non-prorated lifetime limited warranty shall specifically warranty against:
1. Excessive Surface Wear: More than 15% loss of pile fiber weight
2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
4. Delamination
5. Edge Ravel
6. Zippering

E. Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

2.06 FIBER

A. Nylon Fiber: Bulked Continuous Filament (BCF) Nylon in a loop pile construction: TDX Nylon.

B. For yarn containing recycled content, report post consumer and post industrial recycled content of the pile face yarn based on total yarn weight i.e. [(Recycle Content in Pile Face Yarn) / (Total Weight of Pile Face Yarn) x 100]

C. Fiber to contain carbon-core filament for permanent static control. Topical treatments are not allowed.

D. Durable soil protection should be applied to the fiber during product manufacturing to resist fiber soiling.
Application Rate: 2% of Face Weight

2.07 BACKING CHARACTERISTICS

A. Primary Backing: Synthetic Non-Woven.

B. Secondary Backing: Ethos modular with Omnicoat Technology
1. Density (ASTM D-1667): 65 Min. lbs/cu ft +/- 5%
2. Standard Size: 24" x 24"
3. Recycled Content: 50% Recycled Content Secondary Backing
4. Fiberglass Reinforced
5. Face yarn fully fused to secondary backing system that will not delaminate.
6. Delamination: No delamination per ASTM D3936
7. Product must not contain pesticides (US EPA Registered Antimicrobials). Installation adhesives are exempt from this section.

2.08 PERFORMANCE CHARACTERISTICS

A. Test reports for the following performance assurance testing to be submitted upon request. Submitted results shall represent average results for production goods of the referenced style.

B. Requirements listed below must be met by all products.

1. Flooring Radiant Panel
ASTM E-648 / NFPA 253: Class 1 (CRF: 0.45 watts/sq cm or greater)

2. Federal Flammability
CPSC FF 1-70: Passes

3. Smoke Density
ASTM E-662 / NFPA 258: < 450 Flaming Mode

4. Electrostatic Propensity
AATCC 134 (Step & Scuff): 3.0 kV or less

5. Static Coefficient of Friction
ASTM C-1028: Passes ADA Requirements for Accessible Routes (minimum 0.60)

6. Delamination of Secondary Backing of Pile Floor Coverings
ASTM D-3936: No Delamination

7. Lightfastness
AATCC 16E: > 4 @ 100 hours

8. TARR
Severe Traffic: 3.5 minimum

9. Dimensional Stability
Aachen / ISO 2551: Maximum Change +/- 0.149%

11. Moisture Barrier

Moisture Penetration by Impact @ 10 psi: No Penetration of backing after 10,000 impacts

12. Other
As specified in 2.04, 2.05 and 2.06 of this document.

2.09 PRODUCT SPECIFICATIONS

A. Manufactured by Shaw Contract

1. Creative Zone or Set Up Carpet Lines, (Color: TBD)
   A. Construction: Multi-Level Pattern Loop
   B. Gauge: 24
   C. Stitch Rate: 8.0 pile units / inch
   D. Tuft Density: 96.0 tufts/sq inch
   E. Pile Height Average: .187 inch
   F. Pile Thickness: .115 inch
   G. Density Factor (UM44D): 7,513 oz/cu yd
   H. Fiber System: Solution Q Extreme® Nylon, Ecosolution Q100™ Nylon
   I. Dye Method:100% Solution Dyed
   J. R-Value: 0.51 Minimum Hr-ft2-ºF/Btu
   K. Static Coefficient of Friction: Passes ADA requirements.
   L. Static Propensity: AATCC 134: 3.5 kv or less
   M. Flooring Radiant Panel: ASTM E-648 or NFPA 253: Class 1
   N. Acoustic Requirements: Noise Reduction Coefficient (NRC): 0.15 Minimum
   O. Secondary Backing Density: 65 Min. lbs/cu ft +/- 5%
   P. Secondary Backing Recycled Content: 50%
   Q. Total Weight: 101.9 oz/sq yd +/- 5%
   R. Third Party Certification: NSF 140 Platinum rating
   S. Total Product Recycled Content (based on Total Weight): 54.7%
   T. Total Product Post Consumer Content (based on Total Weight): 32.4%
   U. Environmental Impact: No pesticides added to product (US EPA Registered Antimicrobials

B. Substitutes/Alternates

Subject to compliance with all requirements, “or equal” must match the selected colors, have similar aesthetic appearance and tuft density, factory-applied “dry” adhesive, equivalent NSF 140 certification, recycled content certification labels and recyclability. Substitution sample and submittals must be submitted for written approval of quality and color at least ten days prior to bid to be considered. Sample of proposed substitute must be inclusive of both the face and proposed backing (color-only sample not acceptable).

2.10 ACCESSORIES

A. Materials recommended by Manufacturer for patching, leveling, priming, etc.

B. Base, Carpet Edge, and Transition Strips: As specified in applicable sections.

PART 3 EXECUTION

3.01 EXAMINATION / PREPARATION

A. Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.

1. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation.
2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.

B. Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.

C. Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

D. Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.

E. There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

3.02 INSTALLATION - GENERAL

A. Install product in accordance with Manufacturer's installation instructions.

B. Product must meet the requirements of CRI's Green Label Plus (GLP) program for carpet. Provide documentation.

C. Adhesive must meet the requirements of CRI's Green Label Plus program for adhesive. Provide documentation.

D. Adhesives must be below the VOC content limits specified by the South Coast Air Quality Management District Rule #1168. Provide documentation.

E. No US EPA registered pesticides (antimicrobials) are to be added to the product. Antimicrobial treatments are registered with the EPA as preservatives of the products only, and no health benefit should be claimed or expected. If antimicrobials are added then third party documentation with a seal is required stating that the pesticides used will cause NO HARM to the occupants. Installation adhesives are exempt from this section.

F. Product as installed to be securely attached to the floor in compliance with Americans with Disabilities Act (ADA), Section 4.5.3.

G. Where demountable partitions or other items are indicated for installation on top of

finished carpet tile floor, install carpet tile before installation of these items.

H. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

I. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

J. Install pattern parallel to walls and borders.

K. Roll with appropriate roller for complete contact of product with adhesive to sub-floor.

L. Trim carpet neatly at walls and around interruptions.

M. Completed product is to be smooth and free of bubbles, puckers, and other defects.

3.03 PROTECTION & CLEANING

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with Carpet & Rug Institute Installation Standard, "Protecting Indoor Installations."

C. When construction or move-in activities will continue where new carpet is installed, provide non-staining building material paper to protect carpet. Don’t use plastic sheeting as it can trap moisture, and self-sticking plastic sheeting can transfer adhesive residue to carpet that will attract soil.

D. When heavy objects are moved over carpet within 24 hours of installation, use plywood over carpet to prevent buckling and wrinkling.

E. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 09 84 33 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings
   1. Sliding stacked dividers

1.3 REFERENCES

A. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E 84/CAN/ULC S102 Standard Test Method for Surface Burning Characteristics of Building Materials.

C. NFPA 701 (2010; Small Scale Test) Standard Methods of Fire Tests for Flame Resistant Textiles and Films

D. NFPA 705 Recommended Practice for a Field Flame Test for Textiles and Films.

E. SIN 722-06 Flammability Requirements for Fire Retardant Trees and Plants.

F. Title 19 California State Fire Marshal minimum requirements for flame resistance products identified in Section 13115, California Health and Safety Code.

G. NF X 70-100 (1986, Tube Furnace Method) Fire Test for Analysis of Pyrolysis and Combustion Gasses. Evaluation of Toxic Fumes.

H. CCR - California Code of Regulations, Title 24, Part 2, Chapter 25A.

I. DSA - Division of the State Architect.

J. CBC - California Building Code.

K. UL - Underwriters' Laboratories Building Material Directory.

1.4 SUBMITTALS

A. Product Data: Submit Data sheet or Manufacturer Documentation for each product showing dimensions, materials, and colors.

B. Shop Drawings: Submit shop drawings of site plans showing details of construction, product configuration, and related construction.

C. Verification Samples: Submit samples of each chosen material and color.

1.5 QUALITY ASSURANCE

A. Reference Standards:
1. Title 24 CCR, 2019 Building Standards Administrative Code, Part 1, CBSC.
2. Title 24 CCR, 2019 California Building Code (CBC), Part 2, CBSC
3. Title 24 CCR, 2019 California Electrical Code (CEC), Part 3, CBSC
4. Title 24 CCR, Part 4 - 2019 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
5. Title 24 CCR, 2019 California Energy Code, Part 6, CBSC.
6. Title 24 CCR, 2019 California Fire Code, Part 9, (CFC) (2018 IFC, as Amended by CA.
7. Title 24 CCR, California referenced Standards, Part 12 CBSC.
8. Title 19 C.C.R., Public Safety, SFM Regulations.

B. Single-Source Responsibility: Provide acoustical components and installation components by a single manufacturer.

C. Installer: Company with five years minimum documented experience, approved by manufacturer.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

E. Coordination of Work: Coordinate acoustical component work with installers of related work including, but not limited to light fixtures, mechanical systems, electrical systems, and sprinklers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical components to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure:
Acoustical Components: All wet work must be complete and dry prior to installation. Installation shall be carried out where the temperature is between 60 degrees F and 100 degrees F. These temperature conditions must be maintained for optimal component lifespan.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical panel ceilings that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
   2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      a. Warranty Period: 1 year.

B. Acoustic panels:
   a. Warranty Period: Per manufacturer warranty

C. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustical Panels: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. CSI Creative
      Location: 9901 W 74th St, Eden Prairie, MN 55344
      Phone: 800-213-0653
      Email: info@csicreative.com
      Web Address: www.csicreative.com
   2. Substitutions: Under provisions of Section 01 62 00.

2.2 SOUND ABSORBING DIVIDERS

A. Basis-of-Design:
   1. Stackable Dividers by CSI Creative www.csicreative.com

B. Materials:
   1. Soundcore® 100 percent recyclable12mm PET, 60 percent recycled content.

C. Panel color:
   To be coordinated with the Architect; assume two (2) colors.

D. Edge:
   Exposed

E. Attachment Method:
   Sliding system with rubber wheel stoppers; two tracks mounted side by side on a steel angles; two panels per track.

F. Properties:
   a. Acoustic Performance: NRC (ASTM C423): 0.45 - 1.55 varies by design.

   b. Burning Characteristics: ASTM E-84 Class A.

2.3 METAL TRACK CASING

A. Roll-Formed, Sheet-Metal Casing: Type and profile indicated or, if not indicated, manufacturer's standard powder coated casing which responds to design requirements; formed from sheet metal of same material, finish, and color as that used for exposed U-channel on felt panel below.

2.4 PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel track and sliding system attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. Clean substrates and attachment points of dirt, oils, and other substances that could cause issues during installation

B. Install units in accordance with manufacturer's instructions and approved submittals.

3.4 ADJUSTING AND CLEANING

A. Replace damaged or broken components.

B. Adjust units for proper position, uniform appearance and operation.

C. Clean exposed and semi-exposed surfaces using materials acceptable to the manufacturer.

D. Maintenance of components should consist of:

i. Blot spills from material quickly. Wipe with a damp cloth. If stain persists, apply small quantities of carpet or upholstery shampoo solution with a damp cloth (test on inconspicuous location first). Blot well with a clean cloth after each application. Avoid excessive amounts of water. Ensure adequate ventilation if the product is subject to excessive moisture.

3.5. WASTE MANAGEMENT

A. A. Waste Management

i. Coordinate recycling of waste materials with Section 01 74 19 - Construction Waste Management and Disposal.

ii. Collect recyclable waste and dispose of or recycle field generated construction waste created during demolition, construction or final cleaning.

iii. Remove recycling containers and bins from site.

3.6. PROTECTION

A. Protect finished installation from dust and damage from subsequent and ongoing construction activity.

END OF SECTION 09 51 13

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Surface Preparation.
   2. Field application of paints, stains, varnishes, and other coatings (PTG, PTS).
   3. See Schedule and Interior Elevations on the Contract Documents for finished surfaces.

B. Related Sections:
   1. Finish Schedule on the Contract Documents**.**

1.3 SUBMITTALS

1. Product data - Submit product data sheets for each product.
2. Samples:
   a. Submit three painted samples (brush outs), illustrating selected colors and textures for each color and systems selected with specified coats cascaded.
   b. Submit on suitable backing, 8x10 inch size.

1.4 QUALITY ASSURANCE

A. Reference Standards:
   1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2018 IBC, as Amended by CA
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
   5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)

6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)
7. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
8. Title 24 CCR, Part 10 - 2022 California Existing Building Code
9. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

C. Environment Requirements:
   1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
   2. Stucco: Provide a PH test of the stucco that shows compliance with PH requirements of the paint manufacturer. Do not apply paint to stucco at PH levels over 10 or the max amount recommended by the paint manufacturer, whichever is less.
   3. Do not paint when there is a threat of rain within 24 hours or when surface or air temperatures are at or below 40 degrees.
   4. Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control measure, as shown in Table 5.504.4.3, unless more stringent local limits apply. The VOC Content limit for coatings that do not meet the definitions for specialty coatings categories listed in Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Non-flat or non-flat high gloss coating based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources Board, suggested Control Measure, and the corresponding Flat, Non-flat or Non-flat-High gloss VOC limit on Table 5.504.4.3 shall apply. *"TABLE 5.504.4.3-VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS"*

5. Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on the use of certain toxic compounds and ozone depleting substances. In Sections 94522(c)(2) and (d)(2) of the California Code of Regulations, Title 17, commencing with Section 94520 and in areas under the jurisdiction of the Bay Area Air Quality Management District, (additionally) comply with the percent VOC by weight of product limits of Regulation 8 Rule 49. *"TABLE 5.504.4.3-VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS"*

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace paint that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer Warranty: 1 year.

1.8 EXTRA STOCK

A. Provide following with District's permission:
   1. Minimum 2 gallons of each product and each color in an original unopened or new 1 gallon cans.
      a. Color spot each lid.
      b. Identify with formula, location, product and date on the lid.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Paints:
   1. Sherwin Williams Pomar 200 (Basis of Design for VOC, color and quality).
   2. Frazee Paints
   3. Dunn-Edwards.
   4. ICI.
   5. Or equal (Reference substitution requirements in Section 01 60 00)

2.2 PAINTS AND COATINGS

A. Ready mixed, except field-catalyzed coatings.

B. Prepare pigments:
   1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogenous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application. Do not proceed unless substrate is suitable.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D-4442.
   3. Exterior Wood: 15 percent, measured in accordance with ASTM D-4442.

3.2 PREPARATION OF SURFACE

A. General:
   1. Clean all exterior walls and surfaces of loose and scaly paint, dirt, dust, chalk, and other foreign matter by water-blasting using care not to damage substrate followed by hand scraping, sanding or wire brushing after surfaces are dry. Mildew must be treated with household bleach solution and rinsed thoroughly.
   2. Patch, caulk, set protruding nails and repair all surfaces and cracks where necessary with suitable patching materials and smooth off to match adjacent surfaces.
   3. Sand Glossy surfaces to dull surface and remove residue.
   4. Remove mildew from affected surfaces with a solution of Tri-Sodium Phosphate and bleach. Rinse with clean water and allow to dry completely.
   5. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to priming and painting. Patched and bare areas shall be spot primed with the same primer as specified for new work.

6. Rusty metal: Scrape, sand or wire wheel, feathering edges to sound coating. Dust surfaces. Topcoat.
7. Remove soil and body oils completely from surfaces, including handrails, door edges and posts. Treat with Liquid Sandpaper or Dull-N-Bond.
8. Remove hardware, accessories, plates, fixtures and similar items not to be finished. Reinstall at completion.
9. Paint edges of sink cut-outs.

B. Galvanized Surfaces: Remove all oils and contamination from galvanized surfaces scheduled to be painted by washing with a compliant solvent wash.

C. Ferrous Metal: Remove grease, rust, scale, dirt and dust from ferrous metal surfaces. Primer coat shall be applied not less than 30 minutes, nor more than 3 hours after preparation of surface.

D. Primed Metal: Sand and scrape shop primed metal to remove loose primer and rust. Touch-up bare, abraded and damaged areas with metal primer. Feather edges to make touch-up patches inconspicuous.

E. Wood Surfaces:
1. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot prime knots, pitch streaks and sappy sections with a stain blocking primer where surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs after patching material has fully cured.
2. Wood surfaces with peeling areas are to have edges of broken paint film sanded to a feather edge.
3. Back prime wood trim. Paint tops, bottoms, edges and cut-outs of doors.

F. Plaster Surfaces:
1. Plaster surfaces shall be dry and free from efflorescence, encrustations and foreign matter. Fill cracks, holes and imperfections, smoothing repairs to match adjacent texture. Allow repairs to fully cure before priming.
2. Prime plaster surfaces with specified primer. Caulk all cracks.

G. Gypsum Board: Gypsum board shall be dusted clean and free from encrustations and other foreign matter.

H. Preparation of other surfaces shall be performed following specific recommendations of the coating manufacturer.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved

E. Sand wood surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust particles just prior to applying next coat.

G. Stipple all edges and corners to conceal brush marks.

H. Doors: Paint entire door unless otherwise noted, including door top and bottom edge surfaces.

I. Paint entire trim element. Painting of faces only is unacceptable. Trim surfaces must be wrapped with the trim color and not "faced off" or "Hollywooded".

J. Tinting: Tint each primer a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint primer to match the color of the finish coat, but provide sufficient differences in shade of primer to distinguish each separate coat.

3.4 PROTECTION

A. Protect work of other trades and items not intended to receive paint. Install "wet paint" signs to protect newly painted surfaces.

3.5 CLEANING

A. Protection - Carefully protect areas where work is in progress from damage.
   1. Provide and spread clean drop cloths when and where required to provide the necessary protection.
   2. Immediately clean-up all accidental spatter, spillage, misplaced paint and restore the affected surface to its original condition.

B. Clean-up:
   1. At completion of work, remove all materials, supplies, debris and rubbish and leave each area in a clean, acceptable condition.

2. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 SURFACES TO BE FINISHED

A. Paint all new work and areas affected by new work, unless noted otherwise.

B. Do not paint or finish the following items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.

C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
   2. Paint shop primed items occurring in finished areas.
   3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint.
   4. Paint dampers exposed behind louvers, grilles and convector and baseboard cabinets to match face panels.

3.7 PAINT SYSTEMS – EXTERIOR

Satin *(#B33W200) Semi-gloss (#B35W200) Hi-Gloss, (#B35W200)*

A. Paint New Plaster/Stucco, Cement Siding, Shingles, Common Brick and Concrete Walls, Low Sheen (Satin) Finish. 3 coat:
   1. 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W0300 (8 mils wet, 3.2 mils dry).
   2. 2nd Coat: S-W #A89W00507 *(#B35W200)* Acrylic Low sheen (4 mils wet, 1.5 mils dry per coat)
   3. 3rd Coat: S-W #A89W00507 *(#B35W200)* Acrylic Low sheen (4 mils wet, 1.5 mils dry per coat)

B. Paint New Plaster/Stucco, Cement Siding, Shingles, Common Brick and Concrete Walls,
   1. 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W0300 (8 mils wet, 3.2 mils dry).
   2. 2nd Coat: S-W #B35W200 Acrylic Hi-Gloss (4 mils wet, 1.5 mils dry per coat)
   3. 3rd Coat: S-W #B35W200 Acrylic Hi-Gloss (4 mils wet, 1.5 mils dry per coat)

C. Paint New Plaster/Stucco, Cement Siding, Shingles, Common Brick and Concrete Walls, Hi-gloss Finish. 3 coats:
   1. 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W0300 (8 mils wet, 3.2 mils dry).

2. 2nd Coat: S-W #B35W200 Acrylic Hi-Gloss (4 mils wet, 1.5 mils dry per coat)
3. 3rd Coat: S-W #B35W200 Acrylic Hi-Gloss (4 mils wet, 1.5 mils dry per coat)

D. Paint New Plaster/Stucco, Cement Siding, Shingles, Common Brick and Concrete Walls, Low Sheen (Satin) Finish. 3 coat:
1. 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W0300 (8 mils wet, 3.2 mils dry).
2. 2nd Coat: S-W #B33W200 Acrylic Low sheen (4 mils wet, 1.5 mils dry per coat)
3. 3rd Coat: S-W #B33W200 Acrylic Low sheen (4 mils wet, 1.5 mils dry per coat)

E. Paint New Wood Satin Finish, Latex, 3 coat:
1. 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry).
2. 2nd Coat: S-W #B33W200 Latex Satin, (4 mils wet, 1.52 mils dry per coat).
3. 3rd Coat: S-W #B33W200 Latex Satin, (4 mils wet, 1.52 mils dry per coat).

F. Paint New Unpainted Masonry Satin Finish, Latex, 3 coat:
1. 1st Coat: S-W Exterior Acrylic Masonry Primer, A24W00300 (50-100 sq ft/gal).
2. 2nd Coat: S-W Super Paint Exterior Acrylic Latex Satin Finish. A89W00507 (4 mils wet, 1.52 mils dry per coat
3. 3rd Coat: S-W Super Paint Exterior Acrylic Latex Satin Finish. A89W00507 (4 mils wet, 1.52 mils dry per coat

G. Paint New Unpainted CMU Satin Finish, Latex, 3 coat:
1. 1st Coat: S-W Heavy Duty Acrylic Block Filler Primer, B42W00046 (50-100 sq ft/gal).
2. 2nd Coat: S-W Super Paint Exterior Acrylic Latex Satin Finish. A89W00507 (4 mils wet, 1.52 mils dry per coat
3. 3rd Coat: S-W Super Paint Exterior Acrylic Latex Satin Finish. A89W00507 (4 mils wet, 1.52 mils dry per coat

H. Paint New Wood, Satin Finish. Acrylic Latex, 3 coat:
1. 1st Coat: S-W A-100 Exterior Oil Wood Primer, Y24W00020 (8 mils wet, 3.2 mils dry).
2. 2nd Coat: S-W S-W Super Paint Exterior Acrylic Latex Satin Finish. A89W00507 (4 mils wet, 1.52 mils dry per coat
3. 3rd Coat: - S-W Super Paint Exterior Acrylic Latex Satin Finish. A89W00507 (4 mils wet, 1.52 mils dry per coat).

I. Stain New Wood Siding, Shingles (non-roof) and Trim, Semi-Transparent, 2 coat:
1. 1st Coat: S-W Woodscapes Exterior Polyurethane Semi-Transparent Stain A15W00211
2. 2nd Coat: S-W Woodscapes Exterior Polyurethane Semi-Transparent Stain A15W00211

J. Stain New Wood Siding, Shingles (non-roof) and Trim, Opaque Finish, 2 coat:
1. 1st Coat: S-W Woodscapes Exterior Polyurethane Semi-Transparent Stain A15W00211
2. 2nd Coat: S-W Woodscapes Exterior Polyurethane Semi-Transparent Stain A15W00211

K. Paint Ferrous Metals Semi-Gloss, Acrylic, 3 coat:
1. 1st Coat: S-W Kem-Bond HS Universal Metal Primer (Off White) B50WZ0004 (5.0 mils wet, 2.0 mils dry). *(If pre Primed: Show compatibility of primer and this coat can be deleted.)*
2. 2nd Coat: S-W DTM Acrylic Coating Semi-Gloss, B66W00211 (4 mils wet, 1.5 mils dry per coat).
3. 3rd Coat: S-W DTM Acrylic Coating Semi-Gloss, (4 mils wet, 1.5 mils dry per coat).

L. Paint New Galvanized Metals, Semi-Gloss, Acrylic, Latex 2 coat:
1. 1st Coat: Jasco Metal Etch (5.0 mils wet, 2.0 mils dry).
2. 2nd Coat: S-W DTM Acrylic Coating Semi-Gloss, B66W00211 (4 mils wet, 1.5 mils dry per coat).
3. 3rd Coat: S-W DTM Acrylic Coating Semi-Gloss, (4 mils wet, 1.5 mils dry per coat).

M. Elastomeric Coating:
1. 1st Coat - S-W, VIP
2. 1st and 2nd Coats: Minimum (2 mil each coat)

3.8 PAINT SYSTEMS -INTERIOR

A. Paint New – Wood, Trim, Doors, Composite Wood Panels, Semi-gloss Latex, 3 coat:
1. 1st Coat: Pro-Mar white lacquer Undercoater White B44WT0001
2. 2nd Coat: S-W ProMar 200 Interior Latex, Semi-Gloss, Extra white B31W02251. (4 mils wet, 1.3 mils dry per coat)
3. 3rd Coat: S-W ProMar 200 Interior Latex, Semi-Gloss, Extra white B31W02251. (4 mils wet, 1.3 mils dry per coat)

B. Paint Ferrous Metals Semi-Gloss, Acrylic, 3 coat:
1. 1st Coat: S-W Kem-Bond HS Universal Metal Primer (Off White) B50WZ0004 (5.0 mils wet, 2.0 mils dry). *If pre-Primed: Show compatibility of primer and this coat can be deleted.*
2. 2nd Coat: S-W DTM Acrylic Coating Semi-Gloss, B66W00211 (4 mils wet, 1.5 mils dry per coat).
3. 3rd Coat: S-W DTM Acrylic Coating Semi-Gloss, (4 mils wet, 1.5 mils dry per coat

C. Paint New Gypsum Board (All Areas except Public Areas , Restrooms and wet Areas) Satin Finish - Latex, 3 coat:

1. 1st Coat: S-W Pro High Holdout Primer, B28WY2000 Series (5.0 mils wet, 2.0 mils dry)
2. 2nd Coat: S-W ProMar 200 Interior Latex Lo-Sheen ES Enamel Extra White, (4 mils wet, 1.7 mils dry per coat).
3. 3rd Coat: S-W ProMar 200 Interior Latex Lo-Sheen ES Enamel Extra White, (4 mils wet, 1.7 mils dry per coat).

D. Paint New Gypsum Board (Public Areas , Restrooms and wet Areas)Semi-Gloss Finish - Latex, 3 coat:
1. 1st Coat: S-W Pro High Holdout Primer, B28WY2000 Series (5.0 mils wet, 2.0 mils dry)
2. 2nd Coat: S-W ProMar 200 Interior Latex Semi-Gloss Extra White, B20W011251 (4 mils wet, 1.7 mils dry per coat).
3. 3rd Coat: S-W ProMar 200 Interior Latex Semi-Gloss Extra White, B20W011251 (4 mils wet, 1.7 mils dry per coat).

E. Paint New Plaster/ Concrete (Public Areas , Restrooms and wet Areas) Semi-Gloss Finish - Latex, 3 coat:
1. 1st Coat: PrepRite Classic Interior Latex Primer, B28W00101 (5.0 mils wet, 2.0 mils dry)
2. 2nd Coat: S-W ProMar 200 Interior Latex Semi-Gloss Extra White, B31W02251 (4 mils wet, 1.7 mils dry per coat).
3. 3rd Coat: S-W ProMar 200 Interior Latex Semi-Gloss Extra White, B31W02251 (4 mils wet, 1.7 mils dry per coat).

F. Paint New Galvanized Metals, Semi-Gloss, Acrylic, Latex 2 coat:
1. 1st Coat: Jasco Metal Etch (5.0 mils wet, 2.0 mils dry).
2. 2nd Coat: S-W DTM Acrylic Coating Semi-Gloss, B31W02251 (4 mils wet, 1.5 mils dry per coat).
3. 3rd Coat: S-W DTM Acrylic Coating Semi-Gloss, B31W0225 (4 mils wet, 1.5 mils dry per coat).

3.9 COLORS

A. To be selected by Architect from Manufacturers standard color palette and as scheduled on the “Finish Schedule” provided in the plans.

END OF SECTION 09 91 00

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Markerboards.

B. Related Sections include the following:
   1. Division 6 Section "Interior Architectural Woodwork" for custom wood trim for visual display surfaces.

1.3 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel joints.
   2. Show location of special-purpose graphics for visual display surfaces.
   3. Include sections of typical trim members.

C. Schedule: List product, size, and type by room numbers.

D. Samples for Initial Selection: For each type of visual display surface indicated and as follows:
   1. Actual sections of face sheet,
   2. Samples of accessories involving color selection.

E. Samples for Verification: For each type of visual display surface indicated and as follows:
   1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6-inch- long sections of each trim profile.

3. Rail Support System: 6-inch- long sections.
4. Accessories: Full-size Sample of each type of accessory.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of vinyl and polyester fabrics.

G. Qualification Data: For Installer.

H. Maintenance Data: For visual display surfaces to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Reference Standards:
1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA
4. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2021 IFC, as Amended by CA
5. Title 24 CCR, Part 10 - 2022 California Existing Building Code
6. Title 24 CCR, Part 11 - 2022 California Green Building Standards Code (Calgreen Code)
7. Title 24 CCR, Part 12 - 2022 California Reference Standards

B. Installer Qualifications: An authorized representative of motor-operated, sliding visual display unit manufacturer for installation and maintenance of units required for this Project.

C. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fire-Test-Response Characteristics: Provide face materials with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having

jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, pre-fit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
   2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.7 WARRANTY

A. Special Warranty for Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces become slick or shiny.
      c. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Markerboard: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Best-Rite Porcelain Steel Magnetic Dry Erase Board (Basis of Design)
      a. Aluminum Frame, 48" X 96"
      b. Model 2H2NH
   2. Magnaboard by Chatfield Clarke Co.
   3. 555 Series, P3 ceramic steel by Polyvision Corporation.
   4. LCS Markerboard by Claridge Products & Equipment, Inc.;
   5. Or equal (Reference substitution requirements in Section 01 60 00)

2.2 MARKERBOARD ASSEMBLIES

A. Product: Best-Rite Porcelain Steel Magnetic Dry Erase Board (Basis of Design)
   1. Face Sheet: Porcelain steel faced panel. May also be used as a magnetic bulletin board, organization chart and control or status board.
   2. Face Sheet Color: As selected by Architect from manufacturer's full range.
   3. Size: 48" X 96" or as indicated on Drawings.
   4. 2" Map Track at top edge
   5. Aluminum Frame

2.3 ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.
   1. Factory-Applied Trim: Manufacturer's standard.

B. Chalktray: Manufacturer's standard, continuous.
   1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:
   1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 2 inches wide.
   2. End Stops: Located at each end of map rail.
   3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof.
   4. Flag Holder: One for each room.
   5. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.

2.4 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of and markerboards.
   3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.5 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

C. Examine walls and partitions for proper backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and visual display fabric and surfaces.
   1. Seal wall surfaces indicated to receive visual display fabric.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation. Units shall be braced in place to allow curing of adhesive. There shall be no gaps or voids in adhesion and units shall not give when pushed.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Visual Display Boards: Visual Display Boards shall be attached to the wall by spreading adhesive over the entire back of the panel with 1/4inch notched trowel. Panels shall be braced to provide thorough adhesion to the substrate and shall exhibit no “sponginess” when pressed.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

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SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Panel signs (room signs) *(RM-1)*.
   2. Parking signs.
   3. Traffic signs.
   4. Signage accessories

B. Related Sections:
   1. Division 9 Section "Finish Schedule" for color selection.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
   1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
   1. Panel Signs: Full-size Samples of each type of sign required.
   2. Approved samples will not be returned for installation into Project.

E. Qualification Data: For Installer.

F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Reference Standards:
1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA
4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)
7. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
8. Title 24 CCR, Part 10 - 2022 California Existing Building Code
9. Title 24 CCR, Part 12 - 2022 California Reference Standards
10. Americans with Disabilities Act (ADA), Title II or Title III.

B. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

C. Source Limitations: Obtain each sign type through one source from a single manufacturer.

D. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signage fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Signs: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Best Sign Systems Inc. (Basis of Design)
   2. ASI Sign Systems, Inc.
   3. Mohawk Sign Systems.
   4. Sign A Rama.
   5. Or equal

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

B. Product: HC300 ADA Sign System by Best Sign Systems.
   1. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished.
   2. Room, Occupancy signs per plans or As selected from 4 standard copy size signs.
      a. 4" x 2" with up to 4 characters each.
      b. 6" x 2" with up to 8 characters each.
      c. 8" x 2" with up to 12 characters each.
      d. 10" x 2" with up to 14 characters each.
      e. Standard size room identification 6" x 6", 8" x 6", *8" x 8" or 10" x 3".*
      f. Room number signs shall be 6" x 2".

g. Room identification signs with 5" x 1" window opening for occupants name shall be 6" x 6".

1) Insert shall be 5-9/16" x 1-1/8"

3. Toilet Room Signs: As selected from manufacturer's standard 6" x 8".
4. Wayfinding Signs shall be 6" X 8"
5. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
6. Material:
   a. 1/4 inch thick (thicker than standard) "MP", acrylic sheet, ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
7. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by California Contracted Grade 2 Braille raised domed dots. Produce precisely formed characters with square cut edges free from burrs and cut marks, use dome dots. Grade 2 Braille shall be placed directly below last line of letters or numbers, except for room number signs, where they shall be placed directly behind the last number.
8. Copy: 5/8 inch Helvetica Medium with contracted grade 2 Braille.
9. Corners shall be ½" radius
10. Colors: As scheduled in Division 9 Section "Finish Schedule" as selected from full range of standard colors by Architect..

2.3 PARKING SIGNS

A. Material: 0.063" aluminum, screen printed copy on engineer grade reflective vinyl sheeting.
   1. Text: Symbols of accessibility, accessible direction, etc. as indicated on Drawings.

B. Accessible signs are blue with white symbol.

C. Post: 2 inch diameter, schedule 40 galvanized pipe.

2.4 TRAFFIC SIGNS

A. Material: 0.080" aluminum, screen printed copy on engineer grade reflective vinyl sheeting.
   1. Text: Stop, Yield, Do Not Enter, etc. as indicated on Drawings.

B. Post: 2 inch diameter, schedule 40 galvanized pipe.

2.5 ACCESSORIES

A. Mounting Methods: Use concealed fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
   3. Where signs are to be installed on glass use double sided tape. Provide vinyl plastic film in an opaque color, size to match sign, color as selected by Architect to match sign colors. Install on backside/ opposite side of glass from tape to hide the tape from view.

B. Wall-Mounted Panel Signs:
   1. Exterior and Interior Signs on Rough Substrates:
      a. Mechanical Fasteners: Mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
         1) Fastener: Stainless steel screws, tamper-resistant flat head countersink.
         2) Anchors: Suitable for secure attachment to substrate.

C. Parking and Traffic Signs
   1. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions and details noted on plans.
   2. Install sign level, plumb, and at height indicated.
   3. Cap post with galvanized cap.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00

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SECTION 10 26 00 – WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related sections:
1. Section 09 29 00 Gypsum Board

1.2 SUMMARY

A. This section includes the following types of wall protection systems:
1. Handrails
2. Corner Guards
3. Crash rails

1.4 DEFINITIONS

A. Design Reference Sample: Sample of approved manufactured wall protection items, pre-approved by Architect.

1.5 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.
1. Notify the Architect of the meeting day and time 72 hrs. in advance.

1.6 SUBMITTALS

A, General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 “Submittal Procedures”:

B. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.

C. Shop drawings showing locations, extent and installation details of handrails. Show methods of attachment to adjoining construction.

D. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern and end cap attachment and alignment:
   1. 12" (304.8mm) long sample of each model specified including end cap.

E. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.

F. Maintenance data for wall protection system components for inclusion in the operating and maintenance manuals specified in Division 1.

1.7 REFERENCES

A. Reference Standards:
   1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 – 2022 California Building Code, VOL. 1&2 (CBC) (2021 IBC, as Amended by CA
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2021 NEC, as Amended by CA)
   5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
   6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2021 IAPMO UPC, as Amended by CA)
   7. Title 24 CCR, Part 6 - 2022 California Energy Code
   8. Title 24 CCR, Part 9 – 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
   9. Title 24 CCR, Part 11 - 2022 California Green Building Standards Code (Calgreen Code)
   10. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)

C. Perform work in accordance with ASTM C754.

D. American Society for Testing and Materials (ASTM)

E. Underwriters Laboratories (UL)

F. California 01350 specification

1.8 QUALITY ASSURANCE

A. Manufacturer's qualifications: Not less than 5 years' experience in the production of specified products and a record of successful in-service performance.

B. Installer qualifications: Engage an installer who has no less than 3 years' experience in installation of systems similar in complexity to those required for this project.

C. Color match: Provide wall protection components that are color matched in accordance with the following:

1. Delta Ecmc of no greater than 1.0 using CIELab color space. (Specifier note: Construction Specialties' colors are matched under cool white fluorescent lighting and computer controlled within manufacturing tolerances. Color may vary if alternate lighting sources are present.)

D. Fire performance characteristics: Provide engineered PETG wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class A/1 characteristics listed below:

1. Flame spread: 25 or less
2. Smoke developed: 450 or less

E. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.

F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.

G. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.9 PROJECT CONDITIONS

A. Materials must be acclimated in an environment of 65°-75°F (18°-24°C) for at least 24 hours prior to beginning the installation

B. Installation areas must be enclosed and weatherproofed before installation commences.

1.11 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

B. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be maintained.

C. Material must be stored flat.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabricators: Subject to compliance with requirements, provide interior protection products by CS Specialties:

1. CS Acrovyn 4000 by Acrovyn:
   a. Handrails: Model HRB-20N (BASIS OF DESIGN)
      i. Color: Selected from full range of manufacturers colors
      ii. Height: 5 5/8″
      iii. Length: as required to minimize joints

   b. Corner Guards: Model SM-20N (BASIS OF DESIGN)
      i. Color: Selected from full range of manufacturers colors
      ii. Size: 3″ x 3″
      iii. Length: as required to minimize joints
   c. Crash Rails: Model SCR-48MN
      i. Color: Selected from full range of manufacturers colors
      ii. Size: 3″ x 3″
      iii. Length: as required to minimize joints

B. Substitutions will be considered per the Division 1 and general conditions requirements.

2.2 MATERIALS

A. Engineered PETG: Extruded material should be high-impact Acrovyn 4000 with Shadowgrain texture, nominal .078" (1.98mm) thickness. Chemical and stain resistance should be per ASTM D543 standards as established by the manufacturer. Colors to be indicated in the finish schedule from one of manufacturer's available colors and patterns.

B. Regrind PETG: PVC-free regrind absorption cushion.

C. Aluminum: Extruded aluminum should be 6063-T6 alloy, nominal .085" (2.16mm) thickness. Minimum strength and durability properties as specified in ASTM B221.

D. Fasteners: All fasteners to be non-corrosive and compatible with aluminum components. All necessary fasteners to be supplied by the manufacturer.

E. Handrails:

1. Engineered PETG Handrails to be CS Acrovyn: Surface mounted assembly consisting of a continuous extruded aluminum retainer with snap-on Acrovyn 4000 cover and integral shock absorbing cushions where indicated. Color matched mounting brackets to be spaced as indicated on installation instructions. Color matched end caps and corners shall be attached to allow post installation adjustment. Attachment hardware shall be appropriate for wall construction.

F. Corner Guards:

1. Engineered PETG Corner Guards to be CS Acrovyn: Surface mounted guards consisting of continuous retainer with snap-on Acrovyn 4000 cover. Color matched end caps to be provided for both partial and full height applications. Attachment hardware shall be appropriate for wall construction.

2.3 FABRICATION

A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish, and member sizes.

2.4 SOURCE QUALITY CONTROL

A. Defective Units: Architect reserves the right to reject units that do not match approved samples, sample panels, and accepted installations/ mockups. Replace unacceptable units with units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations using only approved mounting hardware and locating all components firmly into position, level and plumb.

B. Temperature at the time of installation must be between 65°-75°F (18°-24°C) and be maintained for at least 48 hours after the installation.

C. Adjust installed end caps as necessary to ensure tight seams.

D. Where splices occur in horizontal runs, splice retainer and rail at different locations along the run.

3.3 PREPARATION

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.

B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer’s installation instructions.

3.4 CLEANING

A. General: Immediately upon completion of installation, clean material in accordance with manufacturer’s recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation

as work progresses and upon completion of work.

3.5 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION 10 26 00

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Toilet accessories:
   1. Toilet seat cover dispensers
   2. Soap Dispensers
   3. Grab Bars at toilet stalls
   4. Grab bars used as wing wall around drinking fountains.
   5. Paper towel Dispensers
   6. Toilet tissue dispensers
   7. Sanitary Napkin Receptacle

B. Related Sections include the following:
   1. Division 9 Section "Gypsum Board" for mounting substrate
   2. Division 9 Section "Ceramic Tile" for mounting substrate

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2023) The 2022 Code of Regulations CCR, CFC, CMC, CPC, CEC Govern
   1. Title 19 CCR, Public Safety, State Fire Marshall Regulations
   2. Title 24 CCR, Part 1 - 2022 Building Standards Administrative Code
   3. Title 24 CCR, Part 2 - 2022 California Building Code, VOL. 1&2 (CBC) (2018 IBC, as Amended by CA
   4. Title 24 CCR, Part 3 - 2022 California Electrical Code (CEC) (2017 NEC, as Amended by CA)
   5. Title 24 CCR, Part 4 - 2022 California Mechanical Code (CMC) (2018 IAPMO UMC, as Amended by CA)
   6. Title 24 CCR, Part 5 - 2022 California Plumbing Code (CPC) (2018 IAPMO UPC, as Amended by CA)
   7. Title 24 CCR, Part 6 - 2022 California Energy Code
   8. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
   9. Title 24 CCR, Part 10 - 2022 California Existing Building Code

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace toilet and bath accessories that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toilet and Bath Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified in a brushed stainless finish.
   1. Bobrick Washroom Equipment, Inc. (BASIS OF DESIGN)
   2. Or equal. Refer to Section 01 60 00 for substitution requirements

B. Under lavatory Guards: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Handy-Shield by Plumberex Specialty Products, Inc. (Basis of Design)
   2. TCI Products.
   3. Truebro, Inc.
   4. Or equal. Refer to Section 01 60 00 for substitution requirements

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated. (brushed stainless steel finish)

B. Steel Sheet: ASTM A 1008, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.

D.` Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and- theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 TOILET ACCESSORIES

A. As indicated on Drawings.
   1. Surface mount toilet seat cover dispenser-Model # B-221
   2. Surface mount soap dispenser – Model # B-2111
   3. Surface mount toilet tissue dispenser (multi-roll)- Model # 2888
   4. Grab bars:
      a. Side: Model # 5806 X 48
      b. Rear: Model # 5806 X 36
      c. Drinking fountain model #819298
   6. Framed mirror - Model # B-165 1830
   7. Surface mount Sanitary Napkin Receptacle: Model B-270

2.4 UNDER LAVATORY GUARDS

A. Under lavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping and allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded-plastic, white.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying.
   1. Provide minimum of six keys to Owner's representative.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations

END OF SECTION 10 28 00

SECTION 22 00 00 - PLUMBING GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.

B. Consult all other Sections to determine the extent of this work specified elsewhere.

C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:

1. California Building Code
2. California Electrical Code
3. California Plumbing Code
4. California Mechanical Code
5. California Energy Code
6. California Green Buildings Standard
7. California Fire Code
8. National Fire Protection Association

1.4 QUALITY ASSURANCE

A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner’s insurance underwriter.

B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities withing Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

A. Secure and pay for all permits, licenses, inspections, and fees required.

B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

A. Paint all exposed piping and supports.

B. See Division 09 for painting.

1.8 COORDINATION

A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.

B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.

C. Coordination meetings shall happen within the first two weeks of construction start. Coordination meeting minutes shall be submitted to the Architect for review.

D. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.

E. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

F. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.

G. Pipes which pitch have right-of-way over those which do not pitch. For example, condensate drains and waste normally have right-of-way.

H. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.

B. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.

C. Furnish all materials and equipment of the same type by the same manufacturer.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

A. No substitute materials or equipment may be installed without the written approval of the Architect.

B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.

C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.

D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

A. Submit shop drawings, manufacturer's data, samples and test reports as specified.

B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.

D. Items indicated in submittal comments shall be provided and installed by contractor.

E. The Engineer and/or Architect shall review the submitted documents for general conformance with the design concept of the project. The review does not relieve the Contractor of the responsibility of deviations from the requirements stated in the contract documents.

F. The Engineer's and/or Architect's review shall not be construed as a completed detailed check of the work submitted, nor shall it relieve the Manufacturer or Contractor of responsibility for errors or omissions of any sort or from the necessity of furnishing any work required by the contract documents.

G. Submittals are not reviewed for quantities, dimensions, weights, fabrication processes, construction methods, coordination with work of other trades, construction safety practices, service clearance, location of control and electrical panels, and other layout constraints. These items shall remain the sole responsibility of the Contractor.

H. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

I. Submittals will be returned to indicate appropriate action taken as follows:

1. No Exceptions Taken.
2. Make Corrections Noted. No Resubmittal Required.
3. Revise and Resubmit.
4. Rejected.
5. Not Reviewed.

J. Use electronic form acceptable to Architect for electronic submittals, containing the following information:

1. Project name.
2. Date.
3. Name and address of Architect and Engineer.
4. Name of Owner.
5. Name, address and contact information of Contractor.
6. Names and contact information of sub-contractor, manufacturer, and supplier.
7. Name of entity that prepared submittal.
8. Category and type of submittal.
9. Specification Section number and title.
10. Drawing number and detail references, as appropriate.
11. Transmittal number, numbered consecutively, and revision number clearly identified.

12. Each item submitted labeled or identified the same as on the drawings.

K. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.

L. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.

M. Submit all items related to specification section in single submittal file. Partial submittals will be deemed incomplete and not reviewed.

N. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.

O. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

2.4 REQUEST FOR INFORMATION

A. While every effort has been made to coordinate the locations of equipment covered under other sections or divisions of these specifications, it is the responsibility of the Contractor to coordinate the exact requirements governed by actual job conditions. Check all information and report any discrepancies before submitting bid or fabricating work.

B. Report discrepancies in time to avoid unnecessary work, and make changes as directed by the Architect.

C. Do not make changes or additions that are subject to additional compensation without written authorization, based upon an agreed price. Any changes made without the above-mentioned authorization shall be at Contractor's own risk and expense.

D. Follow manufacturer’s instructions where they cover points not specifically indicated. However, if they are in conflicts with these drawings and specifications, obtain clarifications from the Architect before starting work.

E. All requests for information shall be accompanied with Contractor’s proposed solution.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

A. Drawings show general arrangement and location of piping and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of piping. Field verify all dimensions.

B. The exact locations of equipment and piping shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost.

C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system. This includes any wiring of sensors, switches, etc.

D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.

B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.

C. Record drawings must include the following as a minimum:

1. Actual equipment locations.
2. Revisions or substitutions to equipment schedules.
3. Pipe size and routing.
4. Dimensional changes to drawings.
5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.

3.4 PROTECTION OF BUILDING

A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.

B. Provide proper protection and storage of all items and tools required.

C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.

C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.

D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.

E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

F. Do not operate water systems until piping has been cleaned, disinfected and start-up strainers are in place.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 FURRING AND PIPE SPACES

A. Spaces provided in the design of the building shall be utilized and the work shall be kept within the furring lines established on the Drawings.

B. Ensure necessary clearances on trim plates at exposed penetrations of walls and floors. If sufficient room is not available above suspended ceiling or vertical shafts obtain clarification from Architect before work is started.

3.9 CUTTING AND PATCHING

A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.

B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.

C. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.

D. Provide sleeves for all piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and piping. When piping is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.

3.10 ACCESS

A. Indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. No controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.

C. Access panels shall be 24" x 24" unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.

D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.

E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.11 SEISMIC RESTRAINTS

A. All equipment, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

B. Piping shall be braced as follows:

1. Brace all gas piping that is 1″ nominal diameter and larger.
2. Brace all piping located in mechanical equipment rooms that is 1 1/4″ nominal diameter and larger.
3. Brace all piping that is 2 1/2" nominal diameter and larger.
4. Transverse bracings at 40′-0″ on center maximum (minimum of one brace per direction of run).
5. Longitudinal bracings at 80′-0″ on center maximum (minimum of one brace per direction of run).
6. Transverse bracing shall be 20′-0″ on center maximum and longitudinal bracing at 40′-0″ on center maximum for gas piping and piping in mechanical rooms.
7. Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24″ of the elbow or tee and is connected to the largest pipe.
8. Do not use branch lines to brace main lines.
9. Provide flexibility in joints where pipes pass through building seismic or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators.
10. At vertical pipe risers, support the weight of the riser at a point or points above the center of gravity of the riser wherever possible. Provide lateral guides at the top and bottom of the riser and at intermediate points not to exceed 30′-0″ on center.
11. No bracing is required if the top of single pipe is suspended 12″ or less from the connection point at the supporting structural member.

3.12 MANUFACTURER'S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.

B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.

C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.13 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping, equipment, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping or equipment within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.14 CATHODIC PROTECTION

A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.15 PIPING AND EQUIPMENT IDENTIFICATION

A. Furnish and install engraved nameplates with 1/4″ minimum lettering at panel mounted control devices, manual control stations, power disconnects, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.

B. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20′ of pipe length.

C. Tag all valves with 2″ diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.16 GUARANTEE

A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.17 TESTING

A. Test all equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.18 OPENINGS

A. Locating and sizing of all openings for piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.19 CLEAN-UP

A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean, and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner.

3.20 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.

B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.

C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.21 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.

B. Provide the following equipment and maintenance information where applicable:

1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.

2. Identifying equipment manufacturer, product name, and model number.

3. Locations.
4. Wiring Diagrams.
5. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
6. Assembly and disassembly instructions.
7. Startup procedures.
8. Routine and normal operating instructions.
9. Normal and emergency shutdown instructions.
10. Troubleshooting diagnostic instructions.
11. Parts list and recommended spare parts including name and address of source of supply.

C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.

D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.

E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION 22 00 00

SECTION 22 05 00 - PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 22 Sections apply to this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to furnish and install complete plumbing and piping systems which shall include, but not limited to fixtures, equipment, piping, valves, and supports.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

1.4 QUALITY ASSURANCE

A. Steel support welding qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

B. Pipe welding qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Each length of pipe, fitting, trap, fixture, or device used in any piping system shall be stamped or indelibly marked with type, weight, quality, and manufacturer's name or mark.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pipes shall be shipped so as not to bend, dent, or otherwise damage the pipe during transport. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading. Any pipe found to have been damaged due to improper handling shall be removed from the jobsite at Contractor's expense.

B. Handling flammable liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

D. Store and handle pipes and tubes having factory-applies protective coatings to avoid damaging coating, and to protect from direct sunlight.

E. Protect stored PE pipes and valves from direct sunlight.

PART 2 – PRODUCTS

2.1 PLUMBING FIXTURES, TRIM AND ACCESSORIES

A. See Schedules on Drawings for plumbing fixtures. Furnish and install all fixtures in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

B. Fixture locations and heights as shown on Architectural Drawings.

C. Comply with applicable provisions and recommendations of CALGreen for water conservation measures.

D. Provide fixtures complete with all trim and materials, fittings, supports, fastening devices, faucets, valves, traps, and appurtenances required.

E. Lavatories and sinks shall be provided with required number of holes by faucet only, unless otherwise specified or required.

F. Install fixtures level, plumb and set at right angles to wall, floor, or both unless otherwise indicated.

G. Make connections between fixtures and waste pipe gastight and watertight with neoprene type gaskets or bowl wax.

H. Where fittings, trim, and accessories are exposed or semi-exposed, provide chrome plated 17 gauge seamless brass.

I. Where fixture supplies and drains penetrate walls, provide chrome plated brass escutcheons with setscrews.

J. Vitreous china: unmarked, true, clear, smooth and bright. Color shall be white unless otherwise indicated.

K. Porcelain lined ware: constructed of smooth, sound iron castings, properly finished, and provided with first quality, high temperature enamel.

2.2 ELECTRIC WATER HEATERS

A. Refer to schedule on Drawings for capacities, recovery rates and electrical characteristics.

B. Acceptable manufacturers: A.O. Smith, Bradford White, or approved equal.

C. Heater shall be ETL or UL listed and shall bear the UL or ETL label.

D. Heater shall meet the energy efficiency requirements of California Title 24.

E. Internal surfaces exposed to water shall be glasslined with an alkaline borosilicate composition fused to steel at 1600°F.

F. Heating elements shall be medium watt density. Each heating element shall be controlled by an individually mounted thermostat and high temperature cutoff switch.

G. Heater shall be provided with anodic protection.

H. Insulation: Factory installed foam insulation with heat loss not to exceed ASHRAE Standard 90.1 and California Title 24. With steel cover with factory backed enamel finish.

I. Provide a minimum two (2) year manufacturer's commercial installation warranty for the entire unit.

J. Water heater shall be seismically braced in accordance with California Plumbing Code.

2.3 GAS PIPING AND FITTING MATERIALS

A. Above Grade Interior Piping: ASTM A53B seamless, Schedule 40, carbon steel pipe.

B. Above Grade Exterior Piping: ASTM A53B seamless, Schedule 40, carbon steel pipe, hot dipped and galvanized coating.

C. Below Grade Piping: Performance Pipe, "DriscoPlex" 6500 PE 2708 or equal ASTM D2513 polyethylene gas distribution pipe.

D. Above Grade Fittings: 150# black malleable iron fittings and threaded joints for pipes 2" and smaller, butt welded joints for pipes 2 1/2" and larger. Hot dipped and galvanized coating for exterior fittings.

E. Press fittings shall be permitted for use where approved by local authorities having jurisdiction and in compliance with current codes.

F. Below Grade Fittings: ASTM D2513, ASTM D3261, and ASTM D2683 fittings with fusion welded joints.

G. Gas Riser: GF Central Plastics, Elster Perfection, or approved equal anodeless riser for transition from below grade polyethylene to schedule 40 steel piping above grade. Minimum horizontal run shall be 30 inches. Minimum vertical length shall be 30 inches; 6 inches minimum above grade.

H. Forged-steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

I. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

J. Gas Cocks: For high pressure gas service use Dezurik Series 400 lubricated gas cock with RS49 or RS51 plug seals, UL listed. On low pressure service lines use Milwaukee BB2 100 Butterball, NIBCO, or approved equal.

K. Seismic pipe connection: Metraflex for gas application.

L. Earthquake Valves: Earthquake ball type actuated automatic gas shut off valve, listed by UL and certified by California State Architect. Pacific Seismic Products.

2.4 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves shall be UL listed for Natural Gas.

B. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

□□ □□ □□□□

D. Joints: 1/2" to 1-1/2" pipe sizes soldered using ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813. 100 percent lead free, 95 percent tin and 5 percent antimony composition, silver bearing solders unless otherwise indicated.

E. Joints: 2" and larger pipe sizes brazed using AWS A5.8/A5.8M, AWS BCuP Series copper-phosphorous alloys.

F. Press fittings shall be permitted for use where approved by local authorities having jurisdiction and in compliance with current codes.

G. Water Hammer Arrestors: Provide at quick closing valves such as flush valves, etc. Certified under Plumbing and Drainage Institute Standard WH201 and by ASSE Standard 1010.

H. Select and size water hammer arrestors in accordance with Plumbing and Drainage Institute Standard WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.

I. Insulation: Insulate outdoor piping with 1" Glass Fiber Insulation and 0.016 aluminum jacket.

2.6 HOT WATER PIPING INSULATION

A. Acceptable manufacturers: Johns Manville, Owens Corning, Knauf.

B. Glass Fiber: Conforming to ASTM C547, rigid molded, non-combustible.

1. [illegible]
2. 1" thickness.
3. [illegible]

C. All insulated piping installed indoors shall be protected with PVC jacketing.

D. All insulated piping installed outdoors or in exposed locations shall be in protected with 0.016 inch thick aluminum jacketing.

E. All insulation shall in accordance to California Energy Code.

2.7 WATER PIPING VALVES

A. All valves shall be the product of a single manufacturer. Milwaukee, NIBCO, Stockham, Crane, or approved equal. 125 PSIG steam service rated and 300 PSIG air and water rated. All valves shall be low lead type per NSF/ANSI Standard 372.

B. Provide valves with screwed or flanged ends as required by the piping system in which they are installed.

C. Shut-off valves 2 inches and smaller: Ball Valve. Bronze body, two piece, full port, extended handle that allows operation of valve without disturbing the insulation.

D. Shut-off valves 2 1/2 inches and larger: Gate Valve. Iron body, resilient wedge, outside screw and yoke.

E. Check valves: Bronze body, swing check, screwed. Provide non-slam check on pumped equipment or quick closing fixtures.

F. Relief valves: Bronze body, spring and diaphragm combination pressure and temperature relief valves with test lever and automatically resetting type thermostatic element. Tested under ANSI Z21.22 and rated relief capacities greater than water heater's input rating.

2.8 WASTE AND VENT PIPING AND FITTING MATERIALS

A. Above Grade Waste: Hubless cast iron soil pipe and fittings, service weight per ASTM A888 and Cast-Iron Soil Pipe Institute Standard (CISPI) 301. Couplings conforming to ASTM and CISPI 310; stainless steel covered neoprene gasket sleeve and stainless steel clamps.

B. Below Grade Waste and Vent: ABS-DWV Schedule 40 per ASTM D2661 D2680 and approved with solvent weld socket fittings.

C. Above Grade Vent: ABS-DWV Schedule 40 per ASTM D2661 D2680 and approved with solvent weld socket fittings.

D. Traps: Provide traps at all fixtures connected to waste systems, except for fixtures having integral traps. Type of trap(s) shall be approved by local codes and be of same material as piping system. Exposed traps for fixtures shall be chrome plated 17 gauge brass.

E. Trap Primers: Pressure drop activated brass trap seal primer with view holes and removable filter screen and requires no adjustments or air pre-charge. Select appropriate model for number of drains being served. Precision Plumbing Products, MIFAB, or approved equal.

F. Drains: Size of drain outlets shall be same as connecting pipe and as indicated on Drawings. Provide trap primer connections on all drains. Drain outlet as required for connection to piping.

G. Temperature and Pressure Relief Drain: Material shall be rated at not less than the operating temperature of the system and approved for such use or shall comply with ASME A 112.4.1.

H. Cleanouts: Install cleanouts of same diameter as pipe (4 inch maximum) where indicated or required by code. Cleanouts shall be installed at all points of change in direction and in horizontal waste lines over 50 feet inside building and 100 feet outside building. Locate minimum 18 inches away from building construction to allow sufficient space for rodding.

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]

2.9 CONDENSATE DRAIN PIPING

A. Condensate drain piping shall be type DWV copper with wrought copper fittings.

B. Condensate drain between condensing gas fired equipment and neutralization kit shall be schedule 40 PVC with solvent weld fittings per ASTM D1785.

C. Condensate drain piping inside building shall be insulated with 1" thick closed cell elastomeric foam insulation. Armaflex, Aeroflex, or approved equal.

D. Exterior condensate drain piping that is CPVC shall be factory rated for outdoor installation and UV resistant. Alternatively, Contractor shall paint exterior piping with UV resistant paint appropriate for pipe material.

2.10 UNIONS AND FLANGES

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, or vent piping. Dielectric unions installed in potable water systems shall conform to lead free requirements.

B. Install unions in piping 2" and smaller and flanges in piping 2 1/2" and larger at each connection to all equipment, tanks, and automatic valves.

C. Locate unions for easy removal of equipment, tank, or valve.

2.11 PIPE HANGERS AND SUPPORTS

A. Provide adequate supports, hangers, guides, thrusters, etc. as necessary to allow for proper movement of the piping at the building seismic joints and at the thermal expansion loops and flexible connectors, taking into account the pipe size, flex connection type, required seismic movement and system operating temperature and pressure.

B. Acceptable manufacturers: B-line, Tolco, Superstrut, Unistrut, or approved equal.

C. Plumbers tape or sheetmetal straps shall not be used for hanging or supporting of pipes.

D. Support horizontal piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)						Hanger Rod Diameter (inches)		
	Steel	Cast Iron	Copper	Plastic			Steel / Cast Iron	Copper	Plastic
				CPVC	PVC	PP			
upto 1	7	-	5	3.5	3	2.75	3/8	3/8	3/8
1 1/4	9	-	7	3.5	3	2.75	3/8	3/8	3/8
1 1/2 & 2	9	5	8	3.5	3.5	2.75	3/8	3/8	3/8
2 1/2	12	5	9	3.5	3.5	3.5	1/2	1/2	1/2
3	12	5	10	3.5	3.5	3.5	1/2	1/2	1/2
3 1/2	-	5	11	-	-	-	5/8	1/2	-
4	12	5	12	4	4	4	5/8	5/8	5/8
5	12	5	13	4	4	4	5/8	5/8	5/8
6	12	5	14	4	4	4	3/4	3/4	3/4
8 to 12	12	5	14	4	4	4	7/8	3/4	7/8

E. Provide hangers at each change in direction and both sides of valves 4-inch and larger. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

F. Support piping on the roof in accordance with the following schedule:

Nominal Pipe Size (inches)	Spacing of Supports (feet)
1/2	6
3/4 or 1	8
1 1/4 or larger	10
1 1/4 or larger (Vertical)	Every floor level

PART 3 – EXECUTION

3.1 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural gas piping according to NFPA 54 to determine that natural gas utilization devices are turned off in piping section affected.

3.2 PIPE SIZES TO EQUIPMENT

A. Pipe sizes indicated, including required valving, shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within 1'-0" of equipment.

3.3 PIPING GENERAL INSTALLATION

A. Thoroughly clean all pipe and maintain in clean condition during construction temporarily capping or plugging ends of pipe when not being worked on.

B. Cut pipes accurately to measurements established at the site and work into place without springing or undue forcing and out of the way of openings, ductwork, and equipment; ream ends of screwed pipes and tubing to original bore before connecting together.

C. Protect all piping located over switchboards, electrical machinery, or equipment against condensation. Insulate piping and install sheetmetal pan underneath piping running above electrical equipment and panels.

D. Where changes in pipe size occur, use only reducing fittings.

E. Provide screwed unions or flanges in locations required for disconnecting and connecting of all equipment.

F. Pipe runs in masonry and concrete floors shall be sleeved for protection.

G. Chase or sleeve all lines rising in footings and where running concealed through walls.

H. Caulk space between pipes and sleeves in exterior walls and in concrete slabs with graphite packing and waterproof plastic compound; caulk with Dow Corning #3 6548 Silicone RTV Foam per manufacturer's recommendations at fire walls.

I. Place escutcheons, stamped with #16 gauge steel and chromium plated, on pipes passing through sleeves in walls, floors or ceiling where exposed to view within a finished area. Grout in all other lines.

J. Support piping where necessary at sufficiently close intervals (and 24" from each fitting and change of direction) to keep it in alignment and to prevent sagging.

K. Anchor vertical risers with hooks, brackets, or clamps to make rigid.

L. All changes of direction of piping shall be made with fittings. Do not bend pipe.

M. Flash roof vent piping through roof with 24 gauge or heavier galvanized flashing. Make watertight with black fibrous mastic. Extend flashing into roofing felt 12" from pipes.

N. Insulate cold water piping outdoors for freeze protection.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]

D. Welded Joints:

1. [illegible]
2. [illegible]
3. [illegible]

E. Brazed Joints:

1. [illegible]

F. Flanged Joints:

1. [illegible]

G. Flared Joints:

1. [illegible]

H. PE Piping Heat-Fusion Joints:

1. [illegible]
2. [illegible]
3. [illegible]

3.5 GAS PIPING INSTALLATION

A. Arrange with Owner and PG&E before turning meter off for tie-in for new installation in location shown.

B. Make necessary connections to supply service to equipment as shown. Make installation in accordance with requirements of governing codes and the National Fire Protection Association.

C. Provide building gas shut-off valve in accessible location outside each building. Provide sign affixed to wall at valve location reading: "Gas Shut-Off." Size and location of the sign shall be as required by the Authority Having Jurisdiction. minimum 1/4" size lettering.

D. Cut pipe accurately to measurements established at building; work into place without springing or forcing; and clear all windows, doors, and other openings. Cutting or other weakening of building structure to facilitate piping installation not permitted.

E. Ream all piping to remove burrs and install to permit free expansion and contraction without damage.

F. Make all changes in direction with fittings and changes in main sizes through eccentric reducing fittings with top of pipe flat.

G. Piping at furnaces, etc. supported independently so pipe weight is not supported by equipment.

H. Provide watertight schedule 40 PVC conduit to protect gas piping installed below covered walkways, covered driveways, and where noted on Drawings. Extend sleeve at least 12 inches beyond any area where it is required to be installed.

I. Provide watertight and gastight schedule 40 PVC conduit to vent gas piping installed below slab inside building. Vent conduit to outdoors.

J. Provide the following:

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

3.6 WASTE, VENT AND CONDENSATE DRAIN PIPING INSTALLATION

A. Lay piping in straight lines at a minimum slope of 2 percent in direction of flow of drainage system, unless otherwise noted on the Drawings.

B. Keep stopper in mouth of pipe when pipe when pipe laying is not in process.

C. Make changes in direction with long sweep or bends. Do not change direction of flow more than 90 degrees.

D. Reducing size of drainage piping in direction of flow is prohibited.

E. Make connections of branches to mains with "Y" fittings and 1/8 or 1/16 bends.

F. Install traps and fresh air inlets where required by code regulations.

G. Install traps with offset drain where required to meet ADA clearances.

H. Install trap primers discharge piping appropriate for trap primers installed. Coordinate discharge piping routing and method of connection to inlet side of floor drain and ensure discharge piping has positive drainage towards connection point floor drain. Slope piping at 1/8" per foot.

I. Install cleanouts at ends of horizontal runs in excess of 5'-0" and every 100'-0" of horizontal run.

J. Makeup cleanout plugs with graphite and oil to facilitate easy removal.

K. Extend vents through roof. Vents may be combined in accordance with California Plumbing Code. Arrange piping passing through roofs to be a minimum of 12 inches from walls or other obstructions so as to permit proper flashing.

L. Do not terminate vent outlet less than ten (10) feet from air intakes.

M. Deliver to the owner at completion of work two (2) suitable wrenches for each type of cleanout installed.

N. Take necessary precautions to protect cleanouts during course of construction.

O. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.7 WATER PIPING INSTALLATION

A. Extend piping for hot and cold water, including mains, risers, and supplies to fixtures and indicated equipment. Carry headers for groups of fixtures full size throughout their length.

B. All domestic water piping shall be arranged to drain to low points and to provide for air elimination at high points.

C. All ferrous to non-ferrous pipe connections shall be made with accepted dielectric pipe or flange union isolating joints to prevent any electrolytic action between dissimilar metals.

D. Insulate all domestic hot and hot water return piping and fittings.

E. Make changes in pipe sizes with reducing tees or reducer fittings.

F. Install a shut off valve at domestic water line to each fixture group so that each group can be shut off without shutting down the other parts of the system.

G. Provide shut off valves for all plumbing equipment, fixtures, and fixture trim which do not have supply stop or integral isolation valves included.

H. Arrange and orientate valves, trap primers, water hammer arrestors, etc. in manner accessible for maintenance and/or removal.

I. No water piping will be permitted below slab on grade unless shown on Drawings.

J. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.8 HANGER AND SUPPORT INSTALLATION

A. Support exposed piping tight to wall with support channels and pipe clamps. All pipe clamps shall include rubber cushion.

B. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

F. Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 are not exceeded.

G. Adjust hangers to distribute loads equally on attachments.

H. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

3.9 PAINTING

A. Paint exposed, exterior metal piping, valves, service regulators, earthquake valves, and piping specialties except components with factory-applied paint or protective coating.

1. [illegible]
   1. [illegible]
   2. [illegible]
   3. [illegible]
   4. [illegible]

B. Paint exposed, interior metal piping, valves, service regulators, earthquake valves, and piping specialties except components, with factory-applied paint or protective coating.

1. [illegible]
   1. [illegible]
   2. [illegible]
   3. [illegible]
   4. [illegible]

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

D. Refer to Division 09 for additional painting requirements.

3.10 TESTING, ADJUSTING, AND CLEANING

A. Provide testing of all installed gas, domestic water, drainage and vent systems during progress of work. Such tests shall be done in the presence of the Owner's representative, and all Authorities Having Jurisdiction. The inspection authority having jurisdiction and the Engineer shall be notified a minimum of 48 hours prior to performance of all tests so that they may be witnessed.

B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.

C. Contractor shall provide all apparatus, temporary work, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as the Contractor will be required to repair and make good, at own expense, any damage caused.

D. Any defects or deficiencies discovered as result of tests shall be immediately repaired and tests shall be repeated until all test requirements are fully met. No caulking of pipe joints to remedy leaks shall be permitted.

E. Gas Piping: All gas piping shall be tested per NFPA 54 to 60 psig for 1 hour without drop in pressure. Equipment and personnel shall be protected from this test procedure. Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System shall not be approved until it can be demonstrated that there is no measurable loss of test pressure during test period.

F. Waste and Condensate Drain Piping: All waste and condensate drain systems shall be tested hydraulically by filling to the highest vent point with water. Piping may be tested in sections. Each section of drainage piping tested shall have all openings tightly closed with screw plugs, or equal device, and stand without loss of level for a period of 4 hours when filled with water which produces at least a 10-foot head at the highest point of the section tested.

G. Water Piping: All water piping shall be tested to 100 psig with potable water and held for 8 hours without drop in pressure before it is covered and concealed. Equipment and personnel shall be protected from this test pressure. After fixtures are connected, test system for 2 hours at 75 psig or prevailing water pressure, whichever is higher.

H. Adjust and regulate all faucets, valves, water heating equipment, etc. and turn over to the Owner in perfect working order.

I. Upon completion of work, clean all equipment and piping installed under this Section.

3.11 DISINFECTION

A. Upon completion of all tests and necessary replacements, all domestic water piping shall be disinfected. Chlorination shall be accomplished by personnel in direct employ of a firm licensed to do this type of work. After work has been accomplished, provide the Owner and Architect with a statement from the laboratory indicating the water is suitable for human consumption.

B. Prior to testing, flush piping with clean water until clean water free of silt or grit is observed for at least one minute.

C. Comply with local requirements where local code requirements are more stringent. Provide necessary labor, equipment, material, and test kits for chlorine application and tests. Make all arrangements with jurisdictional water authority for witnessing chlorination tests and tests of proper disinfection.

D. Sterilize all parts of building water system with water solution containing 50 ppm of available chlorine for at least a 24 hour contact period. After contact period, flush all parts of system with clear water until system tests at no more than 0.2 ppm residual chlorine.

E. Flush thoroughly and submit bacteriological samples to a certified laboratory which shall certify in writing that the water is suitable for drinking.

3.12 TRAINING AND O&MS

A. Refer to Section 22 00 00 Plumbing General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION 22 05 00

SECTION 23 00 00 - MECHANICAL GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.

B. Consult all other Sections to determine the extent of this work specified elsewhere.

C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:

1. California Building Code
2. California Electrical Code
3. California Plumbing Code
4. California Mechanical Code
5. California Energy Code
6. California Green Buildings Standard
7. California Fire Code
8. National Fire Protection Association

1.4 QUALITY ASSURANCE

A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner’s insurance underwriter.

B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities withing Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

A. Secure and pay for all permits, licenses, inspections, and fees required.

B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

A. See Division 09 for painting.

1.8 COORDINATION

A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.

B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.

C. Coordination meetings shall happen within the first two weeks of construction start. Coordination meeting minutes shall be submitted to the Architect for review.

D. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.

E. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

F. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.

G. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

B. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.

C. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.

D. Furnish all materials and equipment of the same type by the same manufacturer.

E. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

A. No substitute materials or equipment may be installed without the written approval of the Architect.

B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.

C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.

D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

A. Submit shop drawings, manufacturer's data, samples and test reports as specified.

B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.

D. Items indicated in submittal comments shall be provided and installed by contractor.

E. The Engineer and/or Architect shall review the submitted documents for general conformance with the design concept of the project. The review does not relieve the Contractor of the responsibility of deviations from the requirements stated in the contract documents.

F. The Engineer's and/or Architect's review shall not be construed as a completed detailed check of the work submitted, nor shall it relieve the Manufacturer or Contractor of responsibility for errors or omissions of any sort or from the necessity of furnishing any work required by the contract documents.

G. Submittals are not reviewed for quantities, dimensions, weights, fabrication processes, construction methods, coordination with work of other trades, construction safety practices, service clearance, location of control and electrical panels, and other layout constraints. These items shall remain the sole responsibility of the Contractor.

H. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

I. Submittals will be returned to indicate appropriate action taken as follows:

1. No Exceptions Taken.
2. Make Corrections Noted. No Resubmittal Required.
3. Revise and Resubmit.
4. Rejected.
5. Not Reviewed.

J. Use electronic form acceptable to Architect for electronic submittals, containing the following information:

1. Project name.
2. Date.
3. Name and address of Architect and Engineer.
4. Name of Owner.
5. Name, address and contact information of Contractor.
6. Names and contact information of sub-contractor, manufacturer, and supplier.
7. Name of entity that prepared submittal.
8. Category and type of submittal.
9. Specification Section number and title.
10. Drawing number and detail references, as appropriate.
11. Transmittal number, numbered consecutively and revision number clearly identified.

12. Each item submitted labeled or identified the same as on the drawings.

K. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.

L. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.

M. Submit all items related to specification section in single submittal file. Partial submittals will be deemed incomplete and not reviewed.

N. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.

O. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

2.4 REQUEST FOR INFORMATION

A. While every effort has been made to coordinate the locations of equipment covered under other sections or divisions of these specifications, it is the responsibility of the Contractor to coordinate the exact requirements governed by actual job conditions. Check all information and report any discrepancies before submitting bid or fabricating work.

B. Report discrepancies in time to avoid unnecessary work, and make changes as directed by the Architect.

C. Do not make changes or additions that are subject to additional compensation without written authorization, based upon an agreed price. Any changes made without the above-mentioned authorization shall be at Contractor's own risk and expense.

D. Follow manufacturer’s instructions where they cover points not specifically indicated. However, if they are in conflicts with these drawings and specifications, obtain clarifications from the Architect before starting work.

E. All requests for information shall be accompanied with Contractor’s proposed solution.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

A. Drawings show general arrangement and location of ductwork, piping, and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of ducts and piping. Field verify all dimensions.

B. The exact locations of equipment, ducts, piping, and registers shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of ducts, registers, piping, and equipment up to the time of installation without additional cost.

C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system. This includes any wiring of sensors, switches, etc.

D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.

B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.

C. Record drawings must include the following as a minimum:

1. Actual equipment locations.
2. Revisions or substitutions to equipment schedules.
3. Duct/pipe size and routing.
4. Dimensional changes to drawings.
5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.
9. Controls sequence of operations.

3.4 PROTECTION OF BUILDING

A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.

B. Provide proper protection and storage of all items and tools required.

C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.

C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.

D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.

E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 CUTTING AND PATCHING

A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.

B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping, or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.

C. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.

D. Provide sleeves for all ductwork and piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and ductwork or piping. When ductwork or piping is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.

3.9 ACCESS

A. Damper operators, filters, and indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. No dampers, controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.

C. Access panels shall be 24" x 24" unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.

D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.

E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.10 SEISMIC RESTRAINTS

A. All equipment, ductwork, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

3.11 MANUFACTURER'S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.

B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.

C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.12 BELT DRIVES

A. Belt drives for fans and equipment shall consist of "V" belts and sheaves.

B. Drives that require not more than two belts shall be provided with variable pitch, driving sheaves to provide some speed adjustment above and below the normal required operating speed; the adjustments to be as near equal as practicable.

C. Belts shall be furnished in matching sets.

D. Fan drives for blower-type fans shall be selected for the proper fan speeds required for the air volumes specified or shown on the Drawings at the static pressures indicated. The static pressures indicated show estimated conditions, which may vary under actual operating conditions. Should it be necessary to adjust the fan speeds to obtain the proper air volume, the Contractor shall make the necessary changes to the drives without additional cost the Owner.

3.13 ELECTRICAL MOTORS FOR HVAC EQUIPMENT

A. Provide electric motors for driving the mechanical equipment. Motors shall be of proper power, construction and speed to suit the specified equipment.

B. Motors and motor control equipment shall conform to NEMA standards and shall be UL listed.

C. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served, and the in-rush current characteristics of the motor with the motor starter selection, so that all items furnished constitute a complete motor control and protection package. Motor shall not operate in the 15% service factor range.

D. Motors located in ducted air streams or subject to outside air elements shall be totally enclosed fan cooled; others shall be open drip-proof design.

E. Motors used with variable frequency drives shall be designed specifically for use on AC inverter power and adjustable speed applications.

F. Each motor shall be factory-wired to a junction box mounted on the motor or on the driven piece of equipment to facilitate single point of field power connection under Division 26.

G. Motors 1/2 HP and smaller shall be rated 120 VAC – single phase – 60 hertz and shall be provided with integral thermal overload protection, unless otherwise indicated.

H. Motors 3/4 HP and larger shall be rated for 208 VAC or 460 VAC – 3 phase – 60 hertz, unless otherwise indicated.

3.14 COORDINATION WITH ELECTRICAL CONTRACTOR

A. Coordinate with the Electrical Contractor on furnishing and installing of controls, motors, starters, etc. Provide copies of submittal and installation data to Electrical Contractor for all items requiring electrical connection.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical work, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Conduit for temperature control wiring shall be responsibility of Mechanical Contractor and shall be of type specified in Division 26.

C. Electrical Contractor shall furnish disconnect switches, motor starters, conduit and wiring for line voltage power to the equipment. See Division 26 and Drawings.

3.15 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping, equipment, or ductwork, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping, equipment, or ductwork within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.16 LUBRICATION

A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.

B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

3.17 EQUIPMENT GUARDS

A. Provide easily (without tools) removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts or machinery. Provide access openings for greasing, oiling, adjusting, etc. All guards shall comply with OSHA requirements and applicable codes.

3.18 CATHODIC PROTECTION

A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.19 PIPING AND EQUIPMENT IDENTIFICATION

A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, motor starters, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.

B. Label each thermostat and switch with equipment connected to the thermostat or switch with black lettering on white background.

C. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20' of pipe length.

D. Tag all valves with 2" diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.20 GUARANTEE

A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.21 TESTING

A. Test all ductwork, equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.22 OPENINGS

A. Locating and sizing of all openings for ductwork and piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.23 CLEAN-UP

A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner.

C. Remove debris and trash from ductwork, fan units, and all air handling equipment. Vacuum clean fan housing, coils, and ducts in vicinity of openings before grilles and registers are installed. Replace construction filters with new filters prior to project completion.

3.24 ACCEPTANCE TESTING

A. Equipment and systems requiring acceptance testing certification for Code Compliance shall have Certificate of Acceptance completed and submitted to enforcement agency. See Drawings for equipment and systems requiring acceptance certification. Tests shall be performed by Certified Mechanical Acceptance Test Technician. Contractor shall be responsible for procuring the required test forms from the California Energy Commission website.

B. The acceptance testing procedures must be repeated, and deficiencies must be corrected by the contractor until the construction/installation of the specified systems conform and pass the required acceptance criteria.

3.25 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.

B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.

C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.26 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.

B. Provide the following equipment and maintenance information where applicable:

1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.
2. Identifying equipment manufacturer, product name, and model number.
3. Locations.
4. Wiring Diagrams.
5. Lubrication Charts.
6. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
7. Assembly and disassembly instructions.
8. Startup procedures.
9. Routine and normal operating instructions.
10. Normal and emergency shutdown instructions.
11. Troubleshooting diagnostic instructions.
12. Parts list and recommended spare parts including name and address of source of supply.

C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.

D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.

E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION 23 00 00

SECTION 23 05 00 - HEATING, VENTILATING, AIR CONDITIONING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 23 Sections apply to this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to furnish and install complete mechanical systems which shall include, but not limited to equipment, ductwork, piping, accessories, insulation, and supports.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

1. Furnaces.
2. Cooling Coils.
3. Condensing Units.
4. Split Systems.
5. Fans.
6. Roof Hoods and Caps.
7. Ductwork.
8. Duct Insulation and Lining.
9. Dampers and Duct Accessories.
10. Flue Vent and Combustion Air Intake.
11. Filters.
12. Diffusers, Registers, and Grilles.
13. Louvers.
14. Refrigerant Piping.
15. Mechanical Supports.
16. Controls.

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

PART 2 – PRODUCTS

2.1 HVAC EQUIPMENT

A. See Schedules on Drawings for equipment data. Furnish and install all equipment in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

2.2 FILTERS

A. Filters shall be 2"-thick of size and number required for equipment and selected for 300 FPM velocity.

B. Filters shall be throwaway type, Class 2 UL listed.

C. Filters shall be minimum MERV 13 based on ASHRAE Standard 52.2 test method.

2.3 ROOF HOODS AND CAPS

A. Roof hoods shall be of size, type, and capacity noted on Drawings.

B. Roof caps for exhaust shall be of size required for duct dimensions noted on Drawings.

C. Roof hood and cap housing shall be constructed of heavy gauge galvanized steel and shall be fully weatherproof and painted with name. Cap and hood shall be reinforced to prevent oil canning and deflecting in high winds. Roof caps and hoods shall be complete with bird screen and roof curb. Distance of hood from roof shall be 18" unless otherwise noted on Drawings.

2.4 DUCTWORK

A. Comply with latest edition of SMACNA HVAC Duct Construction Standards, Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Comply with NFPA 90A when ducts traverse through smoke zones.

B. Comply with UL 181 and California Energy Code Section 120.4 requirements for air distribution ducts and plenums.

C. Ducts shall be minimum 24 gauge thickness. Ducts shall be constructed for 2500 FPM maximum velocity and static pressure classes as follows:

1. Supply Ducts: +3 inch w.g.
2. Return Ducts: - 2 inch w.g.
3. Exhaust Ducts: -2 inch w.g.

D. Longitudinal seams: Groove and Pittsburgh lock seams and slip joints shall be used.

E. Duct Connections: Ductmate industries "Ductmate 35" and "Ductmate 45". Ductmate "Spiralmate" for round duct. Ductmate "Ovalmate" for oval duct.

F. Duct sealing shall be DP 1010 water based duct sealant or other equal and SMACNA approved foil-backed pressure sensitive tape or other equal.

G. Flexible ducts shall be UL 181 and Class I air duct in compliance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, and NFPA 90A and 90B.

H. Flexible ducts shall be two-ply vinyl film supported by helically wound spring-steel wire, R4.2 fiberglass insulation, exterior reinforced laminated vapor barrier film. Duct shall be rated for +2 inch w.g., -1 inch w.g., 4000 FPM maximum velocity, and -10°F to +160°F. Flame Spread less than 25, Smoke Developed less than 50.

2.5 DUCT INSULATION AND LINING

A. All duct insulation and lining shall comply with California Energy Code Section 120.4 requirements for air distribution ducts and plenums.

B. Insulation shall conform to NFPA 90A and 90B, and UL 181, Class I. Insulation shall have Flame Spread not over 25 and Smoke Developed of not over 50.

C. Wherever external duct insulation is specified and internal acoustic treatment of equivalent insulating effect is also required by the Drawings or Specification for the same location, the external insulation may be omitted.

D. Acceptable Manufacturers: Johns Manville, Owens Corning or approved equal.

E. Acoustic Duct Liner: 1" thick, R4.2 in directly conditioned space and 2" thick, R8.0 in unconditioned space or outdoors. Owens Corning Quiet R, or approved equal.

F. Duct Insulation: 3" thick, R8.3 in unconditioned space and 1 1/2" thick, R4.2 for indirectly conditioned space. Owens Corning SoftR Ductwrap FRK, or approved equal.

G. Duct Insulation Outdoor: 2" thick rigid board fiberglass, R8.7 with 0.016 inch thick sheet Aluminum jacket.

2.6 REGISTERS, DIFFUSERS AND GRILLES

A. Acceptable manufacturers: Titus, Krueger.

B. Registers, diffusers, and grilles shall be as indicated on Drawings. Drawings and schedules indicate specific requirements of air inlets and air outlets. Other manufacturers' products with equal quality, appearance, finish, and performance characteristics may be considered.

C. Registers shall have adjustable air pattern for setting in field to match field conditions. Redirect air pattern when required.

D. Refer to Architectural Drawings and Specifications for reflected ceiling plans, elevations, wall and ceiling type and construction. Coordinate frame and border types to accommodate the wall or ceiling specified or shown on the Architectural Drawings.

E. Registers, diffusers, and grilles in fire-rated ceilings or walls shall be all-steel construction.

2.7 DAMPERS AND DUCT ACCESSORIES

A. Acceptable manufacturers:

1. Dampers: Ruskin, Air Balance Inc, Pottorff, or approved equal.
2. Acutuators: Belimo, Honweywell, or approved equal.
3. Turning vanes: Ductmate industries, Duro Dyne, or approved equal.
4. Flexible connectors: Duro Dyne, Ventafabrics, or approved equal.
5. Duct access doors: Ductmate industries, Ward industries, or approved equal.
6. Backdraft dampers: Ruskin, Greenheck, Air Balance Inc, or approved equal.
7. Fire dampers: C&S Air products, or approved equal.

B. Provide volume dampers as specified or shown on the Drawings for proper balancing and distribution of air. Provide single blade dampers in ducts 24 inches in width or less, or 12 inches in height or less. Provide multiple blade, opposed blade design, dampers for all other duct sizes. Coordinate with the balancing contractor and provide additional dampers required for proper air balance.

C. Dampers shall be galvanized steel construction and shall be minimum 2 gauges thicker than duct gauge. Damper shall be pivoted to turn easily, provided with operating handles and locking devices mounted on the outside of the duct in an accessible location. Dampers shall be reinforced for rigidity.

D. Damper actuators for control dampers shall be modulating, 24V power supply, 0-10V DC control input, weatherproof construction.

E. Turning vanes shall comply with SMACNA HVAC Duct Construction Standards, Metal and Flexible for vanes and vane runners. Vane runners shall automatically align vanes.

F. Manufactured Turning Vanes: Fabricate 1 1/2" wide, double vane, curved blades of galvanized steel construction set to 3/4" o.c. Support with bars perpendicular to blades set 2" o.c. and set into vane runners suitable for duct mounting.

G. Flexible duct connectors shall be flame retardant fabrics, coatings, and adhesives complying with UL 181, Class I. Where exposed to weather, fabric shall be double coated with weatherproof, synthetic rubber resistant to UV rays.

H. Duct access doors shall be airtight and suitable for duct pressure class, constructed of galvanized steel with insulation fill as integral part of appropriate thickness. Include cam latches, sash locks, and hinges such that doors can easily be opened without tools. Seal around frame with neoprene or foam rubber.

I. Backdraft dampers shall be multi blade, parallel action gravity balanced, or adjustable counter-balance weighted dampers. Dampers shall have center pivoted blades of maximum 6" width, with sealed edges, assembled in rattle free manner with 90-degree stop. Provide with adjustment device to permit setting for varying differential static pressure.

J. Fire dampers shall be UL listed and conforming to NFPA 90A. Dampers shall be factory installed in sleeves. Dampers shall be arranged to close automatically upon operation of listed fusible link.

2.8 REFRIGERANT PIPING

A. Refrigerant line kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed. Factory insulated lines with flared fittings at both ends. Mueller Streamline Co., JMF Company, or approved equal.

B. Refrigerant pipe insulation shall be flexible closed cell elastomeric foam complying with ASTM C543 with UV retardant, and resistant to mold and mildew.

C. Both suction and liquid lines shall be insulated outdoors and in exposed indoor locations. Concealed Indoor liquid lines may omit insulation for cooling only units.

D. Outdoor piping shall have insulation covered with .016 inch thick aluminum jacket.

E. Indoor exposed piping shall have insulation covered with smooth PVC jacketing, painted per Architect's directions.

F. Refrigerant pipe insulation shall meet requirements of California Energy Code Section 120.3.

2.9 FLUE VENT AND COMBUSTION AIR INTAKE

A. Flue pipe at condensing gas fired equipment shall be schedule 40 PVC with solvent weld fittings per ASTM D1785.

B. Flue pipe at non-condensing gas fired equipment shall be type B double wall metal vent complying with NFPA 211.

C. Combustion air intake pipe for condensing gas fired equipment shall be schedule 40 PVC with solvent weld fittings per ASTM D1785.

D. Combustion air intake for non-condensing gas fired equipment shall be sealed single wall galvanized pipe.

E. All components and assemblies shall be UL listed. All fittings, accessories, support assemblies etc. shall be fabricated from same materials and design as vent pipe; all listed for same assembly.

2.10 LOUVERS

A. Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

B. Verify actual dimensions of openings by field measurements before fabrication.

C. Louvers shall be fixed, formed-metal. Horizontal, drainable blade:

1. Acceptable Manufacturers: Airolite Company, Construction Specialties, Pottorff, Greenheck, or approved equal.

2. Louver Depth: 4 inches.

3. Frame and Blade Material and Nominal Thickness: Aluminum or Galvanized-steel sheet not less than 20 gage (0.0359 inch) for frames and 20 gage (0.0359 inch) for blades.

4. Mullion Type: Exposed.

D. Air Performance: Not more than 0.15 inch w.g. static pressure drop.

E. Fasteners: Use types and sizes to suit installation conditions.

F. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

G. Provide bird screening at interior louver face.

1. Bird Screening: Aluminum or Galvanized steel, 0.5 inch square mesh, 0.041 inch wire.

2. Louver Screen Frames: Fabricated with mitered corners to louver sizes indicated. Non-rewirable, U-shaped frames with same kind and form of metal as indicated for louver. Same finish as louver.

2.11 HANGERS AND SUPPORTS

A. Subject to compliance with requirements, provide products by one of the following manufacturers or other approved equal:

1. B-Line.

2. Mason West.

3. Unistrut.

4. Power Strut.

5. Hilti.

B. Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code. Comply with AWS D1.1 procedures for field welding.

C. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.12 SLEEVES

A. Construct sleeves for pipes passing through walls, floors, partitions, hung or furred ceilings, etc. of minimum 18 gage galvanized steel, flanges on each side of wall, partition, hung or furred ceiling, etc.

B. Provide standard weight galvanized steel pipe sleeves with welded anchor flanges at foundation walls and reinforced concrete or masonry walls.

C. Provide 20 gage galvanized sheet metal sleeves for round ductwork passing through masonry or concrete construction. Rectangular ductwork shall be provided with framed openings through floor and wall construction.

D. Install escutcheons at exposed piping through floors, ceilings, walls and partitions in finished areas, within cabinets and millwork, and piping through all fire-rated separations.

2.13 CONTROLS

A. Furnish and install programmable thermostats where indicated. Coordinate exact locations with Architect.

B. If indicated on Drawings, provide thermostats by specified manufacturer.

C. Thermostats shall comply with latest edition of California Energy Code for demand responsive capabilities and occupancy monitoring if required.

D. Mount thermostats 48 inches above finished floor.

E. Control wiring shall be installed per manufacturer's instructions and wiring diagrams. Wiring in walls and exposed spaces shall be in conduit and in accordance with Division 26. Wiring above ceiling shall be plenum rated cable complying with NFPA 70.

F. Provide and install heavy duty lockable thermostat cover for assembly areas, gymnasiums, and any other public areas required by Owner.

2.14 PAINTING

A. See Division 09 for painting.

B. Prime and paint diffuser boot and duct interiors where visible through grilles with a matte black finish.

C. Prime and paint exposed ductwork, supports, and registers where required by the Architect.

D. Prime and paint louver or grille interiors where required by the Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation clearances, tolerances and other conditions affecting performance of work.

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

3.2 EQUIPMENT INSTALLATION

A. Equipment shall be installed level, on curbs or supports as required and/or indicated on Drawings and in accordance with manufacturer's instructions and recommendations.

B. Equipment shall be installed in locations shown and as complete assemblies with adequate service clearances for access and maintenance as required by codes and equipment installation manuals.

3.3 DUCTWORK INSTALLATION

A. All ductwork gauges, joints, reinforcing, and other details shall be in accordance with latest edition of SMACNA manuals unless otherwise specified.

B. Duct dimensions are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.

C. Provide minimum 24-gauge sheet metal construction for ducts. Construct ducts with NFPA 90A gauges when traversing smoke zones.

D. Construct ducts of galvanized sheet metal, except where otherwise indicated or specified.

E. Construct all ductwork to dimensions indicated, straight and smooth on the inside with neatly finished joints lapped in direction of travel.

F. Construct all ductwork to avoid sharp duct edges. Edges shall be sufficiently rounded and where not possible, sharp edges shall be covered with edge protectors.

G. Fabricate changes in direction, both horizontal and vertical, to permit easy airflow.

H. At exposed duct penetrations of walls, floors and ceilings, provide sheet metal angle type escutcheons fastened to the duct only.

I. Duct Openings: Provide openings where required to accommodate thermometers, smoke detectors, controllers, wiring, conduit, tubing, etc. insert through air-tight rubber grommets.

J. Provide pitot tube openings where required for testing of systems. Include threaded metal cap, spring loaded cap or threaded plug to eliminate any air leakage. Coordinate locations of openings with balancing contractor.

K. Install ductwork to clear all obstructions, preserve headroom, and keep openings clear. Install exposed ducts as high as possible. Coordinate with other trades to maintain minimum 7'-6" clearance above finished floor, unless otherwise indicated.

L. Install ducts unless otherwise indicated, vertically or horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

M. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.

N. Install dampers in branch duct for all air inlets and outlets at accessible location. Dampers shall be capable of adjustments and of being locked into position.

O. Use radius elbows in rectangular ductwork unless otherwise indicated. Centerline radius shall be a minimum 150 percent of duct width. Where space does not permit duct radius, install square elbow with turning vanes.

P. Ends of ducts shall turn over 3/4" for airtight connections between ducts and grilles. The ducts and grilles shall have separate sets of screws. Register frames and ends of ducts shall be properly placed before finishing is begun.

Q. All ducts shall be supported per SMACNA HVAC Duct Construction Standards. Supports and seismic bracing shall be in accordance with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

R. Ducts exposed to weather shall be completely waterproof with outdoor vapor barrier mastic over tape at all joints and seams. Slope entire top of duct down towards sides and coordinate duct slope with roof slope. Arrange standing seam, joints, and flanges to prevent accumulation, ponding or pooling of water.

S. Seal joints and seams of ductwork airtight to SMACNA seal classifications.

T. Protect all ductwork and interiors of ducts shall be clean and free from foreign materials until building is enclosed.

U. All ductwork and sealing shall comply with California Energy Code Section 120.4 requirements for Air Distribution System Ducts and Plenums.

3.4 DUCT SEALING

A. Duct systems shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler air flow rate.

B. Ductwork for constant volume systems that have more than 25 percent of the total duct surface area located outdoors or in unconditioned space shall have the duct leakage confirmed through HERS field verification and diagnostic testing.

C. New duct systems not subject to testing shall meet duct leakage requirements of CMC 603.9.2.

3.5 FLEXIBLE DUCTWORK INSTALLATION

A. Flexible ductwork shall be installed with no runs of more than 5'-0" in length and shall be used only at register connections.

B. Flexible duct shall be installed in fully extended condition, free of sags and kinks, using only minimum length required to make connection. Bends greater than 90° are not allowed.

C. Flexible duct shall be full size of branch. Any change in size to match terminal connection shall be made at terminal. Connect to duct collars, terminal unit connections and air inlets and outlets per manufacturer's instructions.

D. All connections shall be sealed with high pressure duct sealer and secured with 3/8" nylon straps around inside liner of flexible duct.

E. Flexible ducts shall be supported at or near mid-length with 2" wide, 28 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

3.6 DUCT INSULATION AND LINING INSTALLATION

A. Concealed ductwork shall be insulated with fiberglass ductwrap.

B. Provide acoustic lining where indicated on Drawings.

C. All supply and return ductwork shall be insulated, or acoustically lined on the inside when ductwork is exposed.

D. Exhaust duct need not be insulated. Outside air duct indoors need not be insulated. Outside air duct installed outdoors shall be insulated.

3.7 DUCT ACCESSORIES INSTALLATION

A. Flexible connections shall be installed on inlet and outlet duct connections of fans, air conditioning units, furnaces, and all other HVAC equipment. Fabric shall be of weight and strength for service required, properly fitted to render connection airtight. Fabric of sufficient width to provide minimum 4" between connected items.

B. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Install backdraft dampers at roof hoods or louvers connected to ductwork.

C. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units. Access doors shall be large enough for maintenance.

3.8 FILTER INSTALLATION

A. Filter boxes shall have hinged access panels and shall allow tool-less entry.

B. Filter boxes shall be installed such that they are easily accessible and allow unimpeded removal and installation of filters without interference with other obstacles.

C. Filter boxes shall accommodate 2″ thick filter installation.

D. Filter boxes shall be installed with air tight seals and the access door shall fully close with a seal to prevent infiltration of air.

3.9 REGISTERS, DIFFUSERS, AND GRILLES INSTALLATION

A. Locations indicated on the Architectural Drawings shall take precedence. For lay-in ceiling panels, locate in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

B. Install with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

C. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

D. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions.

E. All visible interior surfaces of registers, diffusers, and grilles shall be painted flat black.

F. All visible exterior surfaces of registers, diffusers, and grilles shall be factory off-white finish as standard. Where required by Architect, provide in a color as selected by Architect or provide prime-painted for field painting.

3.10 REFRIGERANT PIPING INSTALLATION

A. Refrigerant pipe installation shall comply with latest editions of ASHRAE 15 and ASME B31.5.

B. Install piping in accordance with manufacturer's instructions and good practices.

C. Install piping adjacent to unit to allow access to unit for service and maintenance.

D. Where required, provide or install additional refrigerant charge per equipment manufacturer's requirements. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

E. Install piping as short and direct as possible, with a minimum number of joints and fittings.

F. Support exposed piping tight to wall with strut channels and pipe clamps. Support concealed pipe on hanging pipe supports, provide bracing where required.

G. Support roof piping at sufficient intervals to prevent pipe sag.

H. Route piping in orderly manner, parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Install piping to conserve space and avoid interference with use of space.

I. Slope piping one percent in direction of oil return. Provide suction traps at base of suction risers where required.

J. Piping shall be cut accurately to measurements established at job site and worked into place without springing or forcing, allowing for proper head room.

K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

L. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.

M. Install insulation without any gaps or cracks and use contact adhesive recommended by manufacturer at joints and connections.

N. When the thickness of insulation is reduced, for example at support hangers, reinforce the reduced thickness with additional insulation.

O. Seal longitudinal seams and end joints of insulation with manufacturer's recommended adhesive to eliminate openings in insulation. Installation to maintain a continuous vapor barrier.

P. Where metal jackets are indicated for insulation, install with 2 inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches on center at end joints.

Q. Use insulated pipe clamps and insulated pipe supports to provide continuous insulation throughout. No section of bare pipe shall come in contact with other metals.

R. Brazed joints: Construct joints according to AWS C3.4M/C3.4.

1. Provide brazing for refrigerant piping system using AWS A5.8/A5.8M, Bag-1 with 15 percent silver, 80 percent copper and 5 percent phosphorous.
2. Clean surfaces to be jointed of oil, grease, rusts, and oxides.
3. Any joints showing evidence of overheating, cracking, poor penetration, or other defects of fit-up or workmanship shall be replaced as directed by the Architect at the contractor's expense.

3.11 FLUE VENT AND COMBUSTION AIR INTAKE INSTALLATION

A. Install all required flues and combustion air intake at gas fired equipment in accordance with manufacturer's instructions and applicable codes.

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing, NFPA, or local codes; whichever is most stringent.

C. Support at intervals recommended by manufacturer to support weight of pipe and all accessories.

D. Seal between sections according to manufacturer's written instructions using sealant recommended by manufacturer.

E. After completing installation, inspect finish. Remove burrs, dirt, and construction debris. Repair damaged finished.

3.12 LOUVERS INSTALLATION

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Comply with SMACNA's Architectural Sheet Metal Manual for fabrication, construction details, and installation procedures.

D. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

E. Use concealed anchorages where possible.

F. Form closely fitted joints with exposed connections accurately located and secured.

G. Protect unpainted galvanized and nonferrous metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses where watertight louver joints are required.

3.13 HANGERS AND SUPPORTS INSTALLATION

A. All equipment, plenums, registers, ductwork, and piping shall be securely anchored to building structure and seismically braced as required by the Drawings and Specifications. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

B. Comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible for hanger rod or sheet metal strap sizes and spacing for duct supports.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install hangers and supports to provide indicated pipe slopes.

H. Adjust hangers to distribute loads equally on attachments.

I. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

J. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding.

3.14 TESTING

A. Comply with more stringent of system manufacturer's requirements and requirement indicated herein.

B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.

C. After completion of refrigerant piping installation, pressurize piping systems to a test pressure of not less than 600 psig using dry nitrogen.

D. Successful testing shall maintain the test pressure for a continuous and uninterrupted period of 24 hours.

E. After completion of pressure testing evacuate piping systems using a vacuum pump with a check valve. Maintain test pressure per manufacturer's requirements for a continuous and uninterrupted period of one (1) hour.

F. Prepare and submit test reports to the Architect for project record.

G. Charge the refrigerant piping system following system manufacturer's written instructions. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

3.15 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature setpoints. Adjust initial airflow settings and discharge airflow patterns.

C. Set field adjustable switches and circuit breaker trip ranges according to manufacturer's written instructions.

3.16 FIELD QUALITY CONTROL

A. Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections. Provide a written report of inspection to the Architect.

B. Engage a factory authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions. Provide completed startup sheets for each piece of equipment to the Architect.

3.17 TRAINING AND O&MS

A. Refer to Section 23 00 00 Mechanical General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION 23 05 00

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, Division 22, and Division 23 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Test and balance air distribution systems.

B. Test and balance hydronic distribution systems and associated equipment and apparatus of mechanical work.

C. Measure acoustic performance and vibration of systems.

1.3 QUALITY ASSURANCE

A. Work shall be performed by independent testing agency certified by AABC or NEBB. Work shall be performed by qualified technicians and trained personnel, using instruments certified accurate to its limits.

B. Use standard forms from AABC's National Standards for Testing, Adjusting and Balancing or NEBB's Procedural Standards for Testing, Adjusting and Balancing.

C. Calibrate instruments at least every twelve months or more frequently if required by the instrument manufacturer.

1.4 COORDINATION

A. Coordinate efforts of HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist with testing, adjusting, and balancing activities.

B. Check for and report defects or deficiencies that may affect balancing.

C. Mechanical Contractor shall advise Balancing Contractor of changes made to the system during construction.

D. Mechanical Contractor shall install test holes or wells complete with removable and replaceable plugs or caps, dampers as specified on Drawings and where required by Balancing Contractor to obtain final system balance.

E. Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, or the addition of dampers for the correct balance as recommended by Balancing Contractor at no additional cost to the Owner.

F. Controls Contractor shall cooperate with and work with the Balancing Contractor when setting damper linkages, minimum outside air dampers, and other air volume devices, and shall be available for readjusting of dampers, devices or controls.

1.5 SUBMITTALS

A. Within 30 days of Contractor's Notice to Proceed, submit the following documents:

1. TAB agency and team member qualifications.
2. Strategies and procedures plan.
3. Sample report forms intended for use on this project.
4. Instrument calibration reports.

B. Submit final, completed balance report prior to request for final mechanical observation of the project.

PART 2 – PRODUCTS

2.1 INSTRUMENTS

A. Utilize test instruments and equipment of type, precision, and capacity as recommended in the AABC or NEBB standards.

B. Instruments for testing and balancing of air and hydronic systems shall have been calibrated within a period of 6 months and verified for accuracy prior to start of work.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to construction, examine the Contract Documents to become familiar with the project requirements and to discover conditions in the systems' designs that may preclude proper testing, adjusting and balancing of systems and equipment.

B. Examine system and equipment installations to verify that balancing devices are properly installed and accessible for effective balancing.

C. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems.

3.2 GENERAL PROCEDURE

A. Perform testing and balancing procedures on each system according to procedures contained in AABC or NEBB standards.

B. Testing and balancing shall not begin until system has been completed and is in full working order.

C. Cut insulation, ducts, pipes, and equipment cabinets for installation or test probes to the minimum extent necessary for balancing procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this project.

D. Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

E. Balance to a maximum measured flow deviation from specified values of plus or minus 10 percent at terminal devices and outlets, and plus or minus 5 percent at equipment.

F. At final inspection, recheck random selections of data recorded in report to verify balance has not been disrupted.

3.3 AIR SYSTEMS PROCEDURE

A. Execute air systems balancing for each air system in accordance with AABC or NEBB standards and as described herein.

B. Conduct tests with supply, return and exhaust systems operating and doors and windows closed or in their normal operating condition.

C. Construction filters shall be removed before testing and balancing. Tests shall be done with final filters installed. Allowances shall be made for air filter resistance at time of tests. The main air supplies shall be set with filter resistance midway between clean and dirty filters.

D. Test and adjust fan or blower speed to design requirements.

E. Test and record motor full load amps. Record each installed motor manufacturer and motor efficiency.

F. Traverse main supply air ducts, using a pitot tube and manometer.

G. Submit data in support of fan deliveries by the following methods:

1. By summation of the air quantity readings at inlets or outlets.

2. By duct traverse of main ducts.

H. Test and record required and measured system static pressures; filter differential, coil differential and fan total static pressure.

I. Test and adjust systems for design recirculated airflow rates.

J. Test and adjust system for outside airflow rates. Measure and adjust outside airflow rates for all fan speeds.

K. Test and record entering and leaving air temperatures in both heating and cooling modes.

L. Inspect and confirm all fire dampers are open, all smoke dampers and fire/smoke dampers are in the correct positions, all duct access doors are closed and fire damper fusible links are accessible.

M. Adjust zones to proper design supply, return, and exhaust flow rates.

N. Test and adjust each air inlet and air outlet and transfer duct to within 10 percent of design requirements.

O. Adjust diffusers, grilles and registers to minimize drafts, dumping, and to prevent short circuiting between supply and return outlets.

P. Vary total system airflow rates by adjustment of fan speeds. Vary branch air quantities by damper regulation.

Q. Record installed fan drive assemblies; fans sheaves, motor sheaves, belts and motors.

R. The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For multi-story buildings, test pressure conditions at ground, intermediate and upper levels. Front doors, stair and vestibule doors, exits and elevator shafts shall be checked for airflow so that leakage does not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

S. Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 0.02 inch wg minimum and 0.05 inch wg maximum shall be achieved, measure with negligible outside wind velocity.

T. Test and adjust each power exhaust fan to achieve building pressure requirements.

3.4 SOUND TESTING PROCEDURE

A. Upon completion of testing and balancing of air systems, conduct sound level tests of conditioned spaces. Use approved calibrated octave band analyzer and record sound levels.

B. Record the following data for each room and system:

1. Background sound level (system off).
2. Sound level heating (system operating).
3. Sound level cooling (system operating).
4. Outdoor sound levels at HVAC equipment locations as directed by the Architect.

3.5 ACCEPTANCE

A. Mechanical systems shall not be considered ready for final inspection until balancing results acceptable to the Architect are obtained.

B. If it is found that specified airflows cannot be achieved on portions of the system, the actual conditions shall be reported to the Architect for consideration of corrective action.

3.6 BALANCE REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

B. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB firm and specialist.
3. Project name.
4. Project location.
5. Architect’s name and address.
6. Engineer’s name and address.
7. Contractor’s name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Summary of contents including the following:

a. Design versus final performance.

b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

C. Report shall be indexed as follows:

1. Air

a. Summary.

b. Procedure.

c. Instrumentation.

d. Drawings.

e. Equipment Summary.

f. Fan Sheets.

g. Fan Curves.

h. Fan Profile Data.

i. Static Data.

j. Traverse Data and Schedule.

k. Terminal Unit Summary.

l. Outlet Data Summary and Schematics (per system).

m. Supply Temperature Data.

n. Building Pressurization Data.

2. Sound

a. Summary.

b. Procedure.

c. Instrumentation.

d. Drawings.

e. Sound Readings.

END OF SECTION 23 05 93

SECTION 23 08 00 - COMMISSIONING OF HVAC SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. The General Conditions, any Supplementary Conditions, Section 23 05 00, Heating Ventilation and Air Conditioning, and Division 01 are hereby a part of this Section as fully as if repeated herein.

1.2 SCOPE OF WORK

A. Work includes performing commissioning process requirements for HVAC systems including mechanical controls, assemblies, and equipment.

B. Refer to Section 01 91 00 General Commissioning Requirements for general commissioning process requirements.

1.3 DEFINITIONS

A. See 01 91 00 General Commissioning Requirements for definitions.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. See 01 91 00 General Commissioning Requirements for contractors' and subcontractors' responsibilities.

B. Provide training on each piece of commissioned equipment. See 01 91 00 for training details.

1.5 CA RESPONSIBILITIES

A. See 01 91 00 General Commissioning Requirements for CA responsibilities

1.6 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CA for inclusion in the commissioning plan:

1. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
2. Schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC systems, assemblies, equipment, and components to be commissioned.

B. Provide the following as discussed in Section 01 91 00, General Commissioning Requirements to General Contractor:

1. Completed system readiness checklist for each piece of commissioned equipment. Completion of system readiness checklist, O&M manual start-up checklist, and any manufacturer provided field start-up checklists.
2. Verification to GC readiness certifying that HVAC systems, subsystems, equipment, and associated controls are ready for functional testing.
3. Corrective action documents resulting from issues in the Commissioning Issues Log or deficiencies found from completing the start-up plan.

1.7 SUBMITTALS

A. Updated submittals: keep the CA informed of all changes to the control system documentation made during programming and setup.

B. Certificates of readiness (completion of the system readiness checklist) to General Contractor for review by CA.

C. Written training plan for review by A/E and CA prior to training. See Section 01 91 00 General Commissioning Requirements for specific items to be included in the training plan.

D. Provide O&M manuals to GC for submission to CA. These are required prior to development of the system readiness checklists.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing.

B. Equipment-specific tools: where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or functional testing, provide such equipment, tools, and instruments as part of the work at no extra cost to owner; such equipment, tools, and instruments are to become the property of owner.

PART 3 – EXECUTION

3.1 PARTICIPATION

A. The contractor shall provide skilled technicians to startup and debug all systems. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Contractor(s) shall ensure that the qualified technician(s) are available and present during the agreed upon schedules to complete the necessary tests, adjustments, and/or problem resolutions.

B. System performance problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

3.2 TESTING PREPARATION

A. Cooperate with the CA in development of the functional test procedures.

B. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

C. Certify that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

D. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

E. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions) as required in functional testing.

F. Provide test holes in ducts and plenums where directed by testing and balance subcontractor to allow air measurements and air balancing. Provide approved plugs.

G. Provide temperature and pressure taps according to contract documents for testing and balance, and commissioning tests.

H. Provide input to GC on construction schedule to include division pipe and duct system testing, flushing, and cleaning. Provide input on equipment start-up and testing and balance schedule to GC. Notify the CA when these items are scheduled.

I. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

J. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CA.

K. Certify that all related A/E punch list items are complete prior to commencing functional tests.

L. Correct deficiencies found from completing the start-up plan prior to conducting functional tests.

M. Provide full points list and keep CA informed of changes in list during programming and setup.

3.3 TESTING AND BALANCE VERIFICATION

A. Prior to performance of testing and balancing work, provide copies of reports, sample forms, checklists, and certificates to the CA.

B. Notify the CA at least ten (10) days in advance of testing and balancing Work, and provide access for the CA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the CA.

D. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

E. The CA will notify testing and balancing Subcontractor five (5) days in advance of the date of field verification.

F. The testing and balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.

G. Failure of an item includes not meeting acceptance criteria as discussed in 23 05 93 Testing, Adjusting, and Balancing for HVAC. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report.

H. Remedy the deficiency and notify the CA so verification of failed portions can be performed

3.4 GENERAL TESTING REQUIREMENTS

A. System readiness checklists and functional test forms will be provided by CA, and executed by installing subcontractors. System readiness checklists are part of the start-up plan that will be provided by the CA to the GC. The GC will distribute the forms and ensure their completion prior to submitting back to the CA for review.

B. CA will oversee execution of the functional tests. Functional tests are provided early to obtain any comments or suggestions.

C. Provide installing technicians, instrumentation, and tools to perform commissioning test at the direction of the CA.

D. Provide skilled technicians who are familiar with this building to execute the functional tests as directed by the CA.

E. Scope of HVAC testing shall include entire HVAC installation, from central equipment for heat generation and air conditioning through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

F. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

G. Tests will be performed using design conditions whenever possible.

H. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

I. The CA may direct that set points be altered when simulating conditions is not practical.

J. The CA may direct that sensor values be altered when design or simulating conditions and altering set points are not practical.

K. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to the CM and GC. After deficiencies are resolved, coordinate with CA to reschedule tests.

L. Installing subcontractor shall be present during all functional tests, whether sub-contractor's equipment is directly involved with the test or not. This is to speed the process of problem resolution as they are discovered during the testing process.

3.5 HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. HVAC Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in mechanical drawings and functional tests (provided by CA) during construction phase.

B. HVAC Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air distribution systems; including HVAC terminal equipment and unitary equipment.

C. See 01 91 00 General Commissioning Requirements for contractor's retesting procedures.

3.6 CONTROL SYSTEM TESTING PROCEDURES

A. Provide a skilled technician who is familiar with this building to execute the functional tests as directed by the CA.

B. Demonstrate the following to the CA during testing of controlled equipment:

1. Setpoint changing features and functions
2. Sensor calibrations
3. Specified functions and features are set up, debugged, and fully operable

4. Graphic screens and value readouts are completed

3.7 TRAINING

A. Provide training on each piece of commissioned equipment. See 01 91 00 and Division 23 for training details.

B. Trainer must be familiar with this building and equipment. Have the technicians that performed work on this building available for answering questions.

END OF SECTION 23 08 00

SECTION 23 09 23 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Furnish a Schneider Electric BACnet Energy Management System (EMS) as specified herein to tie into and match the Mount Diablo Unified School District's (MDUSD) current Energy Management System Standard. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2020, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.

B. The native BACnet EMS shall be as specified herein and consist of a high-speed, peer-to-peer local area network of DDC controllers connected to a dedicated Server PC and other client workstation PC's and Lap Top computers as specified. All HVAC and/or Electrical system points monitored and controlled by the EMS, including the building floor plans as well as all control devices, will be depicted by point-and-click graphics.

C. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers. All controller devices must be BTL tested and listed by the official BACnet Testing Laboratory, having the BTL approval mark issued.

D. All devices in this new project facility location shall be accessible from a single graphical user interface.

E. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

F. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

G. Furnish and install the required software to produce a complete and operational native BACnet EMS as specified herein.

H. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

I. Provide supervisory specialists, including a dedicated project manager, and technicians throughout the duration of the project to assist in all phases of EMS system installation, startup, and commissioning.

J. Provide a comprehensive operator and technician training program as described herein.

K. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

1.2 SYSTEM DESCRIPTION

A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2020, BACnet and achieved listing under the BACnet Testing Laboratories BACnet - Advanced Workstation Software (B-AWS). This system is to control all mechanical equipment, including all unitary equipment such as heat pumps, fan-coils, AC units, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

B. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.

C. All application controllers for every terminal unit (HP, UV, etc.), air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller through BACnet LAN.

D. System Architecture:

1. EMS Contractor shall utilize Owner's IT WAN for connection from BACnet Server to all Global Controllers furnished and installed as part of this project. Connection shall be by way of BACnet/IP as defined in Addendum A (Annex J) of the ANSI/ASHRAE Standard for BACnet. Connection between all Integration Level Global Controllers, the BACnet Server and any client work stations (PC's or Lap Tops) shall be high-speed, peer-to-peer Ethernet as per Standard IEEE802.3. Owner shall furnish and maintain IT WAN infrastructure.

2. EMS Contractor shall provide and install a dedicated MS/TP LAN extending from all Global Controller's to distributed field level controller BACnet devices.

3. Distributed field level controllers are responsible for directly controlling and monitoring HVAC and Electrical system points throughout the facility.

4. The BACnet Server hosts system configurations, programming databases and stores all trend log data. The Server maintains all backup files for system configuration and programming located on Global Controller's and field level controllers and is capable of directly uploading or downloading information from the controllers.

1.3 APPROVED MANUFACTURERS

A. Approved Control Manufacturers:

1. Schneider Electric - no substitution.

2. QUALITY ASSURANCE

A. The Contractor shall be regularly engaged in the manufacturing, installation and maintenance of EMS systems and shall have demonstrated technical expertise and experience in the manufacture, installation and maintenance of EMS systems similar in size and complexity to this project.

B. The EMS system shall be designed, installed, commissioned, and serviced by manufacturer-authorized and trained personnel. System provider shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

C. To provide the level of support and response required by the Owner, the Energy Management System Contractor shall have a fully staffed service department with the following minimum personnel and service offerings:

1. Minimum of 1 (one) Dedicated Support Technician located at a fixed location with access to a network for remote access to the site.

2. Minimum of 1 (one) Dedicated Service Dispatcher to route calls and prioritize service response.

3. Minimum of 5 (five) Dedicated Field Service Technicians. To ensure that there are personnel available to respond to service requests in a timely manner, these technicians are to be dedicated to service and not used on construction projects.

4. Maintain a 24/7 Service Call Center staffed by live operators enabling immediate response to Owner's critical emergency EMS concerns.

D. The EMS Contractor shall provide an on-site, experienced project manager for this work who is responsible for direct supervision of the installation, start up and commissioning of the EMS system.

E. EMS Contractor shall have a proven record of successful native BACnet installations and maintenance of equivalent native BACnet systems for a minimum period of 5 years utilizing the same native BACnet manufacturer's product line that the Contractor proposes to use on this project.

F. Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements.

G. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

H. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

1.4 REFERENCE STANDARDS

A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
2. ANSI/ASHRAE Standard 135-2008, BACnet.
3. Uniform Building Code (UBC), including local amendments.
4. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
5. National Electrical Code (NEC).
6. FCC Part 15, Subpart J, Class A.
7. EMC Directive 89/336/EEC (European CE Mark).
8. UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences.

B. City, county, state, and federal regulations and codes in effect as of contract date.

C. Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.

1.5 SUBMITTALS

A. Drawings:

1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
2. Drawings shall be submitted in the following standard sizes: 11" x 17" (ANSI B).
3. Eight (8) complete sets (copies) of submittal drawings shall be provided.
4. Drawings shall be available in electronic format.

B. System Documentation - Include the following in submittal package:

1. System configuration diagrams in simplified block format.
2. All input/output object listings and an alarm point summary listing.
3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
4. Complete bill of materials, valve schedule and damper schedule.
5. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
6. Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions.
7. For all system elements—operator's workstation(s), building controller(s), application controllers, routers, and repeaters—provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2020.
8. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
9. A list of all functions available and a sample of function block programming that shall be part of delivered system.

1.6 WARRANTY

A. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one (1) year from completion of system acceptance.

B. Extended Warranty – Years 2 to 5. For Characterized Control Valves (CCV), Globe Valves, Butterfly Valves, associated Valve Actuators and Damper Actuators, provide like kind replacement components for any defective material identified and returned in Years 2 to 5 from the date of system acceptance.

C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor.

D. This warranty shall apply equally to both hardware and software. This warranty shall apply equally to both hardware and software.

1.7 RELATED WORK IN OTHER SECTIONS

E. Refer to Division 1 for related contractual requirements.

F. Refer to Section 23 00 00 for General Mechanical Provisions.

G. Refer to Section 26 05 00 for General Electrical Provisions.

PART 2 – PRODUCTS

2.1 CONTROL PROGRAMMING SOFTWARE

A. All DDC programming throughout the EMS network shall adhere to the following standards:

1. Programming on all controllers must be completely operator definable and modifiable and must use a single common programming language for all control devices. Use of pre-canned, factory burned-in DDC programming on controllers is not acceptable and is grounds for rejection of EMS system.
2. Programming shall be developed in an object-oriented graphical programming environment. Line by line code programming is specifically prohibited and is not acceptable.
3. Programming must accommodate all written sequences of operations.
4. Programming shall be modifiable from any server PC, operator console PC and/or portable laptop PC workstation without requiring the burning of new chips or having to directly access the local controller. Software shall accommodate the downloading of programming via established network Ethernet or modem connections.
5. Programming must support the use of virtual software points in the same manner as all physical points are supported.
6. All programming points, virtual or real, for any specific device in the entire EMS network shall be accessible to all other network devices at any given time, regardless of physical location.
7. All programming shall adhere to the BACnet protocols for Standard Command Priorities.

8. Programming software must include a pre-developed cohesive PID (proportional-integral-derivative) algorithm whereby a user can adjust gain and anti-windup coefficients accordingly to effectively accomplish advanced sequence of operation requirements.

2.2 BUILDING (GLOBAL) CONTROLLER

A. General Requirements:

1. BACnet Conformance:
   a. Building Controller shall be approved by the BTL as meeting the BACnet Building Controller requirements.
   b. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
2. Building controller shall be of scalable design such that the number of trunks and protocols may be selected to fit the specific requirements of a given project.
3. The controller shall be capable of panel-mounted on DIN rail and/or mounting screws.
4. The controller shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller.
5. The controller shall be capable of running up to six independent control strategies simultaneously. The modification of one control strategy does not interrupt the function or runtime others.
6. The software program implementing the DDC strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site, using a WAN or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes is also unacceptable.

7. Programming shall be object-oriented using control function blocks, and support DDC functions, All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.
8. Programming tool shall provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed using the operator's workstation or field computer.
9. Controller shall have 6000 Analog Values and 6000 Binary Values
10. Controller IP configuration can be done via a direct USB connect with a operator's workstation or field computer.
11. Controller shall have at a minimum a Quad Core 996Ghz processor to ensure fast processing speeds.
12. Global control algorithms and automated control functions shall execute using a 64-bit processor.
13. Controller shall have a minimum of 1 GB of DDR3 SDRAM on a 533Mhz bus to ensure high speed data recording, large data storage capacity and reliability.
14. Controller shall support two on-board EIA-485 ports capable of supporting various EIA-485 protocols including but not limited to BACnet MS/TP and Modbus.
    a. Ports are capable of supporting various EIA-485 protocols including but not limited to BACnet MS/TP and Modbus.
15. Controller shall support two gigabit speed Ethernet (10/100/1000) ports.
    a. Ports are capable of supporting various Ethernet protocols including but not limited to BACnet IP, FOX, and Modbus.
16. All ports shall be capable of having protocol(s) assigned to utilize the port's physical connection
17. The controller shall have at a minimum four onboard inputs, two universal inputs and two binary inputs.
18. Schedules:
    a. Building controller modules shall provide normal seven-day scheduling, holiday scheduling and event scheduling.
    b. Each building controller shall support a minimum of 480 BACnet Schedule Objects and 480 BACnet Calendar Objects.
19. Logging Capabilities:

a. Each building controller shall log as minimum 1920 objects at 15 min intervals. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.

b. Logs may be viewed both on-site or off-site using WAN or remote communication.

c. Building controller shall periodically upload trended data to networked operator's workstation for long-term archiving if desired.

d. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

20. Alarm Generation:

a. Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as analog object value changes, binary object state changes, and various controller communication failures.

b. Each alarm may be dialed out as noted elsewhere.

c. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.

d. Controller must be able to handle up to 1920 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

21. Demand Limiting:

a. Demand limiting of energy shall be a built-in, user-configurable function. Each controller module shall support shedding of up to 1200 loads using a minimum of two types of shed programs.

b. Load shedding programs in building controller modules shall operate as defined in section 2.1.J of this specification.

22. Tenant Activity Logging:

a. Tenant Activity logging shall be supported by building controller module. Each independent module shall support a minimum of 480 zones.

b. Tenant Activity logging shall function as defined in section 2.1.K of this specification.

B. BACnet MS/TP:

1. BACnet MS/TP LAN must be software-configurable from 9.6 to 115.4Kbps:

a. Each BACnet MS/TP LAN shall support 64 BACnet devices at a minimum

b. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. BACnet IP:

1. The building controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN.
2. Must support interoperability on WANs and CANs and function as a BACnet Broadcast Management Device (BBMD).
3. Each controller shall support at a minimum 128 BBMD entries.
4. BBMD management architecture shall support 3000 subnets at a minimum.
5. Shall support BACnet Network Address Translation.
6. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

D. Expansion ports:

1. Controller shall support two expansion ports.
   a. Combining the two on-board EIA-458 ports with fully loaded expansion ports the controller shall support 6 EIA-485 trunks simultaneously.
2. Expansion cards that mate to the expansion ports shall include:
   a. Dual port EIA-485 card.

E. Power Supply:

1. Input for power shall accept between 17–30VAC, 47–63Hz.
2. Optional rechargeable battery for shutdown of controller including storage of all data in flash memory.
3. On-board capacitor will ensure continuous operation of real-time clocks for minimum of 14 days.

F. Controller shall be in compliance with the following:

1. UL 916 for open energy management.
2. FCC Class B.
3. ROHS.

4. IEC 60703.
5. C-Tick Listed.

G. Controller shall operate in the following environmental conditions:

1. -4 to 149 °F (-20 to 65 °C) without optional battery, or 32 to 122 °F (0 to 50 °C) with optional battery.
2. 0 to 95% RH, non-condensing.

2.3 AUXILIARY CONTROL DEVICES

A. Temperature Sensors:

1. All temperature sensors to be solid-state electronic, interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake, and in a location that is in the shade most of the day.

B. Intelligent Room Sensor with Touch Screen:

1. Hardware:
   a. Room sensor shall include:
      1) Backlit touch screen LCD digital display.
      2) Temperature sensor.
      3) Humidity Sensor.
      4) Programmable Status Light indicator.
      5) CO2 Sensor (as scheduled on prints).
   b. Temperature sensor shall be a Uni-Cuve Type II thermstor with an accuracy of +/- 0.36 °F (0.2 °C) at calibration point over the range of 32-158 °F or better.s
   c. Humidity sensor shall have an accuracy of +/-3% from 10-90% relative humidity or better.

d. The intelligent room sensor's Smart Light shall have a minimum of four colors (Blue, Red, Amber and Green) that will cast a glow onto the wall below the sensor to be used as visual indicator to the occupants of the condition of the system. The color and on/off state of smart light shall be fully programmable.

e. CO2 Sensor shall have an accuracy of +/- 30 ppm over the range of 0-5000 ppm or better.

f. CO2 sensor shall utilize Automatic Baseline Correction to maintain sensor calibration without need for manual calibration.

g. The user shall interact with the smart sensor using a touch screen, with no buttons allowed.

h. The intelligent room sensor shall have provisions for a tamper proof installation requiring tools to be removed from the wall.

i. The touch screen shall have a surface hardness of Mohs 7 or greater to prevent being easily scratched.

j. Controller shall function as room control unit and allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator.

2. Display Content:

a. The intelligent room sensor shall simultaneously display room setpoint, room temperature, and outside temperature at each controller.

b. The intelligent room sensor shall have the ability to add or remove from the display time-of-day, room humidity, and indoor air temp to customize the view for the customer.

c. The intelligent room sensor must have the capability to show temperatures in degrees Fahrenheit or degrees Centigrade.

d. A communication loss or improper communications wiring shall be displayed on the LCD screen to aid in trouble shooting.

e. Information about the version of firmware shall be displayable on the LCD screen.

f. A cleaning mode will be provided to allow for the touch screen to be cleaned without inadvertently making changes to system parameters.

g. The intelligent room sensor shall have the ability to display the status of a lighting zone status and control the on/off state of the zone from the touch screen using a tenant accessible display page.

h. The intelligent room sensor shall have the ability to display the status of a window zone (e.g. blinds) and control the on/off state of the zone from the touch screen using a tenant accessible display page.

i. After Hours Override shall:

1) Override time may be set and viewed in 30 minute increments.

2) Override time countdown shall be automatic, but may be reset to zero by occupant from the sensor.

3) Time remaining shall be displayed.

4) Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.

3. Other Modes:

a. The intelligent room sensor shall also allow service technician access to hidden functions for advanced system configuration. This functionality shall be accessed protected with a configurable pin number.

b. Field service mode shall allow access to common parameters as dictated by the application's sequence of operations. The parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

c. Balance mode shall, if intelligent room sensor is connected to VAV controller, allow a VAV box to be balanced and all air flow parameters viewed. The balancing parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

4. Intelligent Room Sensor shall be in compliance of the following:

a. UL Standard for Safety 916

b. FCC Part 15.107 & 109, Class B, CFR47-15

c. EMC Directive 89/336/EEC (European CE Mark).

C. Wall Sensor:

1. Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to field service tool through wall sensor port.

2.4 ELECTRONIC ACTUATORS AND VALVES:

A. Quality Assurance for Actuators and Valves:

1. UL Listed Standard 873 and C.S.A. Class 4813 02 certified.
2. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
3. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.

B. Actuators for damper and control valves 0.5–6 inches shall be electric unless otherwise specified, provide actuators as follows:

1. UL Listed Standard 873 and Canadian Standards Association Class 481302 shall certify actuators.
2. NEMA 2 rated actuator enclosures for inside mounting. Use additional weather shield to protect actuator when mounted outside.
3. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.
4. Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
5. Position indicator device shall be installed and made visible to the exposed side of the actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the actuator.
6. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.
7. A pushbutton gearbox release shall be provided for all non-spring actuators.
8. Modulating actuators shall be 24 VAC and consume 10 VA power or less.
9. Conduit connectors are required when specified and when code requires it.

C. Damper Actuators:

1. Economizer actuators shall utilize analog control 2–10 VDC; floating control is not acceptable.

2. Electric damper actuators (including VAV box actuators) shall be direct shaft-mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or set-screw type fasteners are not acceptable.
3. One (1) electronic actuator shall be direct shaft-mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one (1) actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
4. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One (1) electronic actuator shall be direct shaft-mounted per damper section. See below execution section for more installation details.
5. Actuator mounting for damper and valve arrangements shall comply with the following:
    a. Damper actuators: Shall not be installed in the air stream.
    b. A weather shield shall be used if actuators are located outside. For damper actuators, use clear plastic enclosure.
    c. Damper or valve actuator ambient temperature shall not exceed 122 degrees F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.
    d. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.
    e. Damper mounting arrangements shall comply to the following:
        1) The ventilation subcontractor shall furnish and install damper channel supports and sheet metal collars.
        2) No jack shafting of damper sections shall be allowed.
        3) Multi-section dampers shall be arranged so that each damper section operates individually. One (1) electronic actuator shall be direct shaft mounted per section.
    f. Size damper sections based on actuator manufacturer's specific recommendations for face velocity, differential pressure and damper type. In general:

1) Damper section shall not exceed 24 ft-sq. with face velocity >1500 FPM.
2) Damper section shall not exceed 18 ft-sq. with face velocity > 2500 FPM.
3) Damper section shall not exceed 13 ft-sq. with face velocity > 3000 FPM.

g. Multiple section dampers of two or more shall be arranged to allow actuators to be direct shaft mounted on the outside of the duct.

h. Multiple section dampers of three or more sections wide shall be arranged with a 3-sided vertical channel (8 inches wide by 6 inches deep) within the duct or fan housing and between adjacent damper sections. Vertical channel shall be anchored at the top and bottom to the fan housing or building structure for support. The sides of each damper frame shall be connected to the channels. Holes in the channel shall allow damper drive blade shafts to pass through channel for direct shaft-mounting of actuators. Open side of channel shall be faced downstream of the airflow, except for exhaust air dampers.

i. Multiple section dampers to be mounted flush within a wall or housing opening shall receive either vertical channel supports as described above or sheet metal standout collars. Sheet metal collars (12-inch minimum) shall bring each damper section out of the wall to allow direct shaft-mounting of the actuator on the side of the collar.

2.5 ENCLOSURES

A. All controllers, power supplies and relays shall be mounted in enclosures.

B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment. Outdoor enclosures must be either NEMA 3R or NEMA 4.

C. All temperature control panels shall be fabricated in a UL-listed panel shop. Field assembled temperature control panels are not allowed.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence.

B. Notify the owner's representative in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections, installation, and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3.3 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum three (3) feet of clear access space in front of units. Obtain approval on locations from owner's representative prior to installation.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.

C. Identify all equipment and panels. Provide permanently mounted tags for all panels.

D. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections, and sized to suit pipe diameter without restricting flow.

3.4 INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring associated with the EMS system. All wiring shall be installed neatly and professionally, in accordance with all national, state and local electrical codes.

B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate with electrical contractor.

F. All control wiring in mechanical, electrical, telephone and boiler rooms to be installed in raceways. Exposed control wiring shall also be installed in raceways. All other control wiring to be installed without conduit neatly and inconspicuously per local code requirements.

3.5 DDC OBJECT TYPE SUMMARY

A. Provide all database generation.

B. Displays

1. System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.

C. Run Time Totalization

1. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

D. Trend Log

1. All binary and analog object types (including zones) shall have the capability to be automatically trended.

E. Alarm

1. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.

F. Database Save

1. Provide backup database for all standalone application controllers on disk.

3.6 FIELD SERVICES

A. Prepare and start logic control system under provisions of this section.

B. Start up and commission systems. Allow sufficient time for startup and commissioning prior to placing control systems in permanent operation.

C. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for one (1) year or as specified.

D. Provide owner's representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.7 TRAINING

A. Provide application engineer to instruct owner in operation of systems and equipment.

B. Provide system operator's training to include (but not be limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of three persons.

C. Provide on-site training above as required, up to 24 hours as part of this contract.

1. Provide first training session before occupancy, once all systems are functioning and tested.
2. Provide second training 4-5 months after occupancy.
3. Provide final training 11 months after occupancy. This training should focus on answering questions about controls system. Collect questions at least two (2) weeks before training and tailor training materials to address these questions.

3.8 DEMONSTRATION

A. Demonstrate complete operating system to owner's representative.

B. Provide certificate stating that control system has been tested and adjusted for proper operation.

END OF SECTION 23 09 23

SECTION 26 05 00
GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. The work of this Section consists of providing all required labor, supervision, materials and equipment (except equipment furnished by the Owner to be installed by the Contractor) to satisfactorily complete the work shown on the drawings and/or specified in all Sections of Division 26 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete and fully operating facility. The work shall include but not be limited to the following:
   1. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated electrical systems.

1.2 RELATED WORK:

A. This Section provides the basic Electrical Requirements which supplement the General Requirements of Division 1 and apply to all Sections of Division 26.

1.3 STANDARDS AND CODES:

A. All work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:
   1. California Electrical Code (CEC)
   2. National Fire Protection Association (NFPA):
      a. 70 National Electrical Code (NEC)
   3. American National Standards Institute (ANSI) Publications:
      a. C2-02 National Electrical Safety Code
   4. Code of Federal Regulations (CFR):
      a. 29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)
   5. Electronics Industries Association / Telecommunications Industries Association (EIA / TIA)
   6. Institute of Electrical and Electronics Engineers (IEEE)
   7. National Electrical Testing Association (NETA):
      a. Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, Standard ATS
   8. National Electrical Manufacturers Association (NEMA)
   9. Occupational Safety and Health Act (OSHA) Standards
   10. State of California Public Utilities Commission:
      a. General Order 128 Rules for Construction of Underground Electric Supply and Communication Systems
   11. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.

12. Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Safety labeling and listing by other organizations, such as ETL Testing Laboratories, may be substituted for UL labeling and listing if acceptable to the Owner. Provide service entrance labels for all equipment required by the NEC to have such labels.

1.4 SUBMITTALS:

A. As specified in Division 1. Submit to the Engineer shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

B. Submittals are required for all items, regardless of whether they are furnished as specified or are substituted.

C. Submittals shall be provided prior to the purchasing and installation of the item(s) being submitted. Any work done prior to the final approval of the submittal shall be done at risk and any modifications, changes, or re-work that may be required resulting from the final submittal review shall be provided by the Contractor at no additional cost to the project.

D. Information to be submitted includes manufacturer's name, trade name, equipment model number, nameplate data, equipment drawings including: size, layout dimensions and capacity, manufacturer's descriptive literature of cataloged products, diagrams, fault and coordination study, seismic calculations, test data, and performance and characteristic curves as applicable. Furnish project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

E. If submittal information includes multiple products, items being submitted for approval shall be clearly identified and Items not to be used on the project shall be clearly marked out. Submittals consisting of manufacturer's catalogs without clearly marking out items not being used will be returned as not reviewed.

F. Organize submittals for equipment and items related to each specification section together as a package.

G. Submit submittal packages in digital PDF format.

1. Certificates of Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the

quality of that item. Certification shall not contain statements that imply the item does not meet requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications;" or "equal or exceed the service and performance of the specified material." Certifications shall state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official, authorized to sign certificates of conformance.

H. Substitutions:
   1. The equipment included in the Contract Documents is used to establish standards of quality, utility, size, and appearance. Equipment which in the opinion of the Engineer is equal in quality, utility, size, and appearance will be approved as substitutions to that specified.
      a. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are approved by the Engineer prior to bidding.
   2. Substitutions will be accepted for review where there is a reasonable reason for the substitution. Reasonable reasons include:
      a. Cost savings to the Owner. Include deductive change order with submittal.
      b. A product with features providing additional benefits to the end user.
      c. Improved finished environment, lay out of the final installation, or space savings over the specified equipment.
      d. Delivery considerations.
      e. Owner's specific requests.
   3. Where items are noted as "or equal", a product of equal design, construction and performance will be considered.
   4. Any item proposed as a substitute shall be accompanied by the following:
      a. Drawings and/or data giving sizes, capacities, all pertinent test data, catalog cut sheets, product information, and all other necessary information required to substantiate that the product is equal or exceeds that specified.
      b. A summary sheet noting each performance characteristic noted in the specification section or elsewhere in the contract documents of the specified product and the corresponding performance characteristics of the proposed substitution. The summary sheet shall contain the following information:
         1) Reason for Substitution Request
         2) Pertinent Performance Characteristics
         3) Specified Product Values
         4) Substituted Product Values
      c. Any substitution request that does not include the above information shall be rejected.

d. Refer to the end of this specification section for an example form to be used for substituted products. A Microsoft Word version of the form can be provided to the Contractor for their use upon request.

5. Substitutions shall be equal, in the opinion of the Engineer, to the specified equipment. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted equipment to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Plans or Specifications.
6. Contractor shall be responsible for coordination of the substituted products with other trades. Provide all additional connectivity, equipment, increased wire/conduit size, installation hardware, testing, and other miscellaneous appurtenances as required for a complete and fully functional installation.
7. Only one substitution will be considered for each product specified.
8. Alternate manufacturers must be submitted for approval 10 days prior to bid date unless noted otherwise in Division 1.
9. The Contractor shall be responsible for all expenses in connection with the substitution materials, process, and equipment, including the effect of his/her substitution on him/her, his/her sub-Contractor's or other Contractor's work. No substitution shall be permitted without written authorization of the Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

I. Change Orders:
1. Where a change to the contract documents would result in a credit due to the Owner or a value add change to the project, provide a detailed change order request for the Engineer to review.
2. It shall be understood that the Engineer's review of costs associated with the change order shall not constitute approval of the change order or their associated costs. The Engineer's review shall be intended to assist the Owner in evaluating the costs associated with the change only. Final approval or rejection of the change order shall be at the discretion of the Owner.
3. Change order requests shall include the following information:
   a. Description of the change
   b. Reference to the document or written direction to make the change:
      1) In the case of design-team directed changes, reference the drawing/sketch number or RFI number.
      2) In the case of Owner-directed changes, reference the email, memo, or other written direction from the Owner and provide a copy of the direction.
   c. Detailed cost breakdown for the change:

1) Line item for each material noting:
   (a) Material used (e.g. ¾" EMT)
   (b) Total quantity (e.g. 200lf)
   (c) Unit cost (e.g. $2/lf)
   (d) Total materials cost (e.g. $400)
   (e) Unit labor hours (e.g 6hrs/100lf)
   (f) Total labor hours (e.g. 12hrs)
   (g) Hourly rate (e.g. $90/hr)
   (h) Total labor cost (e.g. $1,080
2) Total labor hours for each position (e.g. Journeyman vs. Superintendent)
3) Total materials cost
4) Overhead
5) Profit
6) Total change order value (positive for value added changes, negative for credits)

J. Closeout Submittals:
   1. As-built drawings: Submit As-Built Record documents as in accordance with section 3.05 below.
   2. Cost analysis: Submit final cost information including original bid and any change orders broken down by system, material and labor costs (as applicable):
      a. Power distribution
      b. Lighting and lighting controls
      c. Low Voltage systems
   3. Operation and Maintenance Manuals: Furnish O & M Manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 1. Electrical O & M Manuals shall be provided in a single transmittal and shall include as a minimum:
      a. Copies of equipment supplied on the project.
      b. Instruction manuals including operation instructions and maintenance requirements/recommendations.
      c. List of suppliers for all equipment with addresses and telephone numbers.
      d. List of service support for all equipment with addresses and telephone numbers.
      e. Copies of all test reports required in Division 26 specification sections.
      f. Spare Parts: For each piece of equipment, submit a list of recommended spare parts. Include part numbers and the name, address, and telephone number of the supplier.
      g. Other closeout documentation and test results as required under other sections of the specifications.

h. Warranty for all work, equipment, and systems, including Contractor's general warranty.
i. All warranties begin as per the Contract, Division 1 or final acceptance of the Work by the Owner, Architect, Engineer, and Authority Having Jurisdiction, which ever is later.
    1) Lamps, drivers, and ballasts are to be covered as per specification 26 51 00.
    2) Manufacturer's Warrantees and Guarantees that are longer than the base contract/specified amount are to be provided with the manuals.
    3) The Contractor is responsible for all Warranty and Guarantee work whether or not the Manufacturer also Warrantees and Guarantees the product.

1.5 CONTRACT DOCUMENTS:

A. Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for the installations.
    1. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
    2. All drawings and divisions of these specifications shall be considered as whole. This Contractor shall report any apparent discrepancies prior to submitting bids.
    3. Should there be a conflict or discrepancy between the drawings and specifications, or between different drawings sheets, or between different specification sections, the most expensive option shall be required, at the discretion of the Engineer.

B. Drawings:
    1. The Drawings shall govern the general layout of the completed construction:
        a. Locations of equipment, inserts, anchors, panels, pullboxes, manholes, conduits, stub-ups, fittings, power and convenience outlets, lighting fixtures and ground connections are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.
        b. The general arrangement and location of existing conduits, piping, apparatus, etc., is shown as existing on drawings or specified. The drawings and specifications are for the assistance and guidance of the Contractor, exact locations, distances and elevations are governed by actual field conditions. Extreme accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The Contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by

the Engineer.

1.6 COORDINATION:

A. Coordinate the electrical work with the other trades, code authorities, utilities and the Engineer:
   1. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.
   2. Coordinate does not mean to only send a Request For Information. Coordinate implies that the Contractor is to take the lead in bringing all of the necessary organizations together to coordinate the work and to provide for the associated costs.

B. Where connections must be made to existing installations, properly schedule all the required work, including the power shutdown periods. Schedule and carry out shutdowns so as to cause the least disruption to operation of the Owner's facilities:
   1. Include costs for work during non-normal working hours and temporary facilities as may be required.
   2. Include costs as necessary for sub-Contractors as necessary to accomplish the specified work.

C. When two trades join together in an area, make certain that no electrical work is omitted. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.

D. Operations:
   1. Perform all work in compliance with Division 1:
      a. Keep the number and duration of power shutdown periods to a minimum.
      b. All shutdowns which would interfere with the operations of Owner's equipment or facilities shall be coordinated with the Owner a minimum of 15 days in advance.
         1) Where Owner's equipment or facilities must remain operational during the shutdown, provide sufficient means to temporarily backup the interrupted services for the duration of the interruption.
      c. Show all proposed shutdowns and their expected duration on the construction schedule.
         1) If the construction schedule is created and maintained by others, make sure that the associated information is incorporated.
         2) Failure by the Contractor to properly schedule and plan for such activities is not a basis for additional compensation.
      d. Carry out shutdown only after the Engineer has favorably reviewed the schedule. Submit power/communications interruption schedule 15 days prior to date of interruption. Failure to provide schedule with adequate review time may result in rescheduling of the work at the Contractor's expense.

E. Construction Power:

1. See Division 1 Temporary Utilities.

F. Storage:
1. Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from sun, weather, condensation, dust, water, or construction operations.

G. Damaged Products:
1. Notify the Engineer in writing in the event that any equipment or material is damaged. Obtain approval from the Engineer and Manufacturer before making repairs to damaged products.

H. Order material in such a timely manner and after approval of the same so as to insure that the approved material is available to be installed on site in a timely manner. Additional costs or substitutions necessitated because the Contractor failed to order material in a timely manner are not reimbursable. Costs associated with processing of paperwork by the Owner and design consultants resultant of such failures to coordinate the work by the Contractor shall have such costs reimbursed by the Contractor.

1.7 LOCATIONS:

A. General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located.
1. Dry Locations:
a. All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
2. Wet Locations:
a. All locations exposed to the weather or contact with water (such as kitchen areas subject to directional water spray as a means of cleaning surfaces), whether under a roof or not, unless otherwise designated on the Drawings.

1.8 SAFETY AND INDEMNITY:

A. Lock out Requirements:
1. Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147

B. The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and properly during performance of the work. This requirement will apply continually and not be limited to normal working hours.
1. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
2. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants,

and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the Engineer, their Consultants or their officers, agents and employees.

PART 2 PRODUCTS

2.1 **STANDARD OF QUALITY:**

A. Material and Equipment: Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.

B. Service Support: Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.

C. Manufacturer's Recommendations: Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.2 FASTENERS:

A. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.3 FINISH REQUIREMENTS:

A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B. In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Ensure that all equipment and materials fit properly in their installation.

B. Perform any required work to correct improperly fit installation at no additional expense to the Owner.

C. Equipment Installation:
   1. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
   2. In all rooms with concrete floors, install all floor mounted equipment on reinforced concrete pads as shown. Insure that pads are seismically secured to the building structure. The Contractor, suppliers, and fabricators shall take this requirement into consideration when designing, fabricating, and installing panels and other enclosures so that height above the floor of the operating handles of electrical devices meets the requirements of these Specifications and applicable codes.
   3. Mount all metal panels which are mounted on or abutting concrete walls or any outside walls a minimum of ¼ inch from the wall, and paint the back sides of the panels with Bituminous Coating, Rust-oleum C9578 Coal Tar Epoxy Coating or approved equal. Film thickness shall be 10 mils minimum.

D. Cutting, Drilling and Welding:
   1. Provide the required cutting, drilling welding that is required for the electrical construction work. Comply with Division 1 requirements.
   2. Structural members shall not be cut or drilled, except after approval by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.
   3. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel. Where welding is required, it shall be accomplished by tradesmen certified to do such work. Provide fire and other protection as appropriate.

3.2 FIELD TESTS:

A. Test shall be in accordance with Acceptance Testing specifications issued by the National Electrical Testing Association (NETA).

B. Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all circuits and components, and demonstrate as ready for service. Perform each operational check three times to ensure the circuit and components are working properly. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Engineer prior to any test so

that the tests may be witnessed.

C. Provide instruments, other equipment, temporary facilities as may be necessary, and material required for the tests. These shall be of the type designed for the type of tests to be performed and shall be calibrated by a recognized testing laboratory within three months prior to testing.

D. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions.

E. Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Engineer. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.

F. Perform calibration and adjustment on all equipment. Where the values for adjustment are not shown on the Drawings, obtain the proper values from the Engineer.

G. Maintain records of each test and submit five copies to the Engineer when testing is complete. All tests shall be witnessed by the Owner and/or Engineer at their discretion. These records shall include:
   1. Name of equipment tested.
   2. Date of report.
   3. Date of test.
   4. Description of test setup.
   5. Identification and rating of test equipment.
   6. Test results and data.
   7. Name of person performing test.
   8. Owner or Engineer's initials.

H. Items requiring testing as a minimum:
   1. Ground field grid.
   2. Circuit Breakers.

3.3 PAINTING OF EQUIPMENT:

A. Factory Applied: Electrical equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section.

B. Field Applied: Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.4 RECORDS:

A. Maintain one copy of the contract Drawing Sheets on the site of the work for recording the record "as built" condition. After completion of the work, the Contractor shall neatly and carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:
   1. Drawings and associated as-built changes shall be completed in AutoCAD or Revit and submitted in CAD/Revit as well as PDF format. Documents with hand-written changes or with RFI responses and field sketches pasted on shall not be acceptable. Engineer shall make digital backgrounds of original contract documents available for Contractor's use upon request.
   2. Cable Size and Type: Provide the size and type of each cable installed on the project.
   3. Substructure: Where the location of duct lines, adjacent utilities, cable boxes, and manholes are found to different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
   4. Record (As Built) Drawings: At the completion of the Work the Contractor shall provide a set of record "as built" drawings over to the Owner for his use.
      a. Record drawings are required to be transmitted within 30 days of beneficial occupancy.
      b. Transmittal and approval process:
         1) Contractor is to transmit one digital copy for review and comment.
         2) After acceptance of the above, the Contractor is to transmit three printed sets and one digital reproducible set.
         3) Contractor to provide information on their company in the margin of record drawings along with the date of the revisions and the associated revision number.

3.5 POSTED OPERATING INSTRUCTIONS:

A. Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:
   1. Single line diagrams, wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment at each major piece of distribution equipment.
   2. Start up, proper adjustments, operating, lubrication and shutdown procedures.
   3. Safety precautions.
   4. The procedure in the event of equipment failure.
   5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

B. Instruction to Owner's Personnel:

1. Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or systems has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for field instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.
2. Contractor shall video record all training sessions and shall provide the Owner with a copy of the recording at the conclusion of the training. Recording shall be in digital video format (MP4, AVI, or similar) and shall be provided on USB stick or DVD labeled with the Contractor's contact information, the training topic, and date of training.
3. Contractor shall maintain an attendance sheet from each session which contains the following information:
   a. Attendees with associated arrival and departure time.
   b. Topics covered.
   c. Information provided.
   d. Signatures of attendees taken at the completion of the session.

3.6 CLEAN UP:

A. Thoroughly clean all soiled surfaces of installed equipment and materials, including, but not limited to, removal of all dirt, dust, debris, and unused construction materials.

B. Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Engineer.

(1)

(2) **Substitution Request Form**
(3)
(4) Project Name: _____
(5) Request Date: _____
(6)
(7) Submittal Name: _____
(8) Submittal Number: _____
(9)
(10) Reason for Substitution Request (check all that apply):
(11)

	Reason	Additional Information
☐	Cost savings to the owner	*(Note cost savings here)*
☐	A product with features providing additional benefits to the end user	*(Note benefits here)*
☐	Improved finished environment, lay out of the final installation, or space savings over the specified equipment	*(Note benefits here)*
☐	Delivery considerations	*(Note schedule savings here)*
☐	Owner's specific requests	*(Note requested change and who made request here)*

(12)
(13) Product Data Information (provide one line per performance characteristic):

Property	**Specified**	**Substitution**	**Meets**	**Exceeds**
(e.g. Thermal Rating)	*(e.g. 90° C)*	*(e.g. 90° C)*	☒	☐
			☐	☐
			☐	☐

			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

(14)

END OF SECTION

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Demolition drawings are based on casual field observation and existing record documents.

C. Report discrepancies to Architect before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner at least 24 hours before partially or completely disabling system.
   2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
   3. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.
B. Wiring connectors.
C. Electrical tape.
D. Heat shrink tubing.
E. Oxide inhibiting compound.
F. Wire pulling lubricant.
G. Cable ties.
H. Firestop sleeves.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
H. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.
I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Most Recent Edition, Including All Revisions.

O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

R. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Armored cable is not permitted.

E. Metal-clad cable is not permitted.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

H. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. Equipment Ground, All Systems: Green.
d. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com/#sle.
b. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
c. Southwire Company: www.southwire.com/#sle.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 6 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
      c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.4 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Manufacturers:
   1. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

C. Provide equipment grounding conductor unless otherwise indicated.

D. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

2.5 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but

not less than required for the rating of the overcurrent protective device.

3. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors where connectors are required.
5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
6. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.

H. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy LLC; _____: www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy LLC; _____: www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.6 ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
   2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Burndy LLC; _____: www.burndy.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Manufacturers:
      a. Burndy LLC; _____: www.burndy.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. Ilsco: www.ilsco.com/#sle.

D. Wire Pulling Lubricant:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. American Polywater Corporation: www.polywater.com/#sle.
      c. Ideal Industries, Inc: www.idealindustries.com/#sle.
   2. Listed and labeled as complying with UL 267.
   3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   4. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.
   1. Manufacturers:
      a. Burndy LLC; _____: www.burndy.com/#sle.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

1. Products:
    a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
    b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
    1. Products:
        a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
    1. Unless dimensioned, circuit routing indicated is diagrammatic.
    2. When circuit destination is indicated without specific routing, determine exact routing required.
    3. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
    4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
    5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
    6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Exposed Cable Installation (only where specifically permitted):
   1. Route cables parallel or perpendicular to building structural members and surfaces.
   2. Protect cables from physical damage.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated

connector surfaces.

5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 26 05 53.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using UL listed materials and methods.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Field quality control test reports.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.
8. Provide bonding for metal building frame.

G. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    b. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
    c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

1. Use insulated copper conductors unless otherwise indicated.
    a. Exceptions:
        1) Use bare copper conductors where installed underground in direct contact with earth.
        2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use exothermic welded connections for accessible connections.
4. Manufacturers - Exothermic Welded Connections:

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

E. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has cured.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Comply with the following. Where requirements differ, comply with most stringent.
a. NFPA 70.
b. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load

to be supported with minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.

C. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
1. Manufacturers:

E. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.
3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
4. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2-inch diameter.
    b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
    c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.

d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
e. Outlet Boxes: 1/4-inch diameter.
f. Luminaires: 1/4-inch diameter.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts or expansion anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
b. Comply with MFMA-4.
c. Channel Material: Use galvanized steel.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.

I. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.

K. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.

L. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

M. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.

N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O. Secure fasteners in accordance with manufacturer's recommended torque settings.

P. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Flexible metal conduit (FMC).
C. Liquidtight flexible metal conduit (LFMC).
D. Galvanized steel electrical metallic tubing (EMT).
E. Rigid polyvinyl chloride (PVC) conduit.
F. High-density polyethylene (HDPE) conduit.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.
B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
D. Section 26 05 33.16 - Boxes for Electrical Systems.
E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
D. ASTM D1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal); 2010 (Reapproved 2019).
E. ASTM D1598 - Standard Test Methods for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure; 2021.
F. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings; 2018.

G. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

H. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing; 2016.

I. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing; 2016a (Reapproved 2022).

J. ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD); 2016.

K. ASTM F2176 - Standard Specification for Mechanical Couplings Used on Polyethylene Conduit, Duct and Innerduct; 2017.

L. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

M. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

N. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

O. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

P. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

Q. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

R. NEMA TC 7 - Solid-Wall Coilable and Straight Electrical Polyethylene Conduit; 2021.

S. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

U. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

V. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

W. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

X. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Y. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

Z. UL 746C - Polymeric Materials – Use in Electrical Equipment Evaluations; Current Edition, Including All Revisions.

AA. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

BB. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

CC. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

DD. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.6 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit or HDPE.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
   4. Where rigid polyvinyl chloride (PVC) conduit or high-density polyethylene (HDPE) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows for bends.
   6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
   7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use rigid PVC conduit.
   2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use rigid PVC conduit.
   3. Within Concrete Walls Above Ground: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from concrete.
   5. Where galvanized steel electrical metallic tubing (EMT) or galvanized steel rigid metal conduit (RMC) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

E. Concealed Within Hollow Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
      b. Where exposed below 20 feet in warehouse areas.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

M. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet.

N. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

C. Provide conduit, fittings, supports, and accessories required for complete raceway system.

D. Provide products listed, classified, and labeled as suitable for purpose intended.

E. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Underground, Interior: 1 inch (27 mm) trade size.
   3. Underground, Exterior: 1-inch trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.

3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Conduit with integral fittings, such as Allied Tube and Conduit's "Kwik-Couple" are not permitted.

C. Interior conduits shall be color-coded based on the wiring or system type they serve. Paint shall be factory applied by the manufacturer
1. Normal Power Systems: No color
2. Emergency and Standby Power Systems: Yellow
3. Fire Alarm: Red
4. Security: Orange
5. Telephone and Data: Blue
6. Audio/Visual: Purple
7. Other Low Voltage: Green

D. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

E. Fittings:
1. Manufacturers:
a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
1. Manufacturers:
a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.
    a. Do not use die cast zinc fittings.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
    1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
    1. Manufacturers:
        a. ABB; T&B: www.electrification.us.abb.com/#sle.
        b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
    2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
    3. Material: Use steel or malleable iron.
        a. Do not use die cast zinc fittings.

2.6 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
    1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
    2. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
    3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Conduits with integral fittings similar to Allied Tube & Conduit's "Kwik-Fit" shall not be used.

D. Interior conduits shall be color-coded based on the wiring or system type they serve. Paint shall be factory applied by the manufacturer
    1. Normal Power Systems: No color
    2. Emergency and Standby Power Systems: Yellow
    3. Fire Alarm: Red
    4. Security: Orange
    5. Telephone and Data: Blue
    6. Audio/Visual: Purple
    7. Other Low Voltage: Green

E. Fittings:
    1. Manufacturers:
        a. ABB; T&B: www.electrification.us.abb.com/#sle.
        b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression/gland or set-screw type.
   a. Do not use indenter type connectors and couplings.

2.7 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. ABB; Carlon: www.carlon.com/#sle.
   2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   3. Cantex Inc: www.cantexinc.com/#sle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Expansion fittings similar to Carlon's "E945" series shall not be used.
   2. Manufacturer: Same as manufacturer of conduit to be connected.
   3. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.8 HIGH-DENSITY POLYETHYLENE (HDPE) CONDUIT

A. Manufacturers:
   1. ABB; Carlon: www.electrification.us.abb.com/#sle.
   2. Blue Diamond Industries, LLC: www.bdiky.com/#sle.
   3. Eastern Wire + Conduit, a division of Atkore International: www.easternwire.com/#sle.

B. Description: NFPA 70, Type HDPE high-density polyethylene solid-wall conduit complying with ASTM F2160 and NEMA TC 7; list and label as complying with UL 651A; Schedule 40 unless otherwise indicated.

C. Joining Methods: Approved by HDPE conduit manufacturer.

D. Mechanical Fittings: Comply with ASTM F2176; list and label as complying with UL 651A.

E. Butt Heat Fusion Fittings: Comply with ASTM D3261.

F. Socket Fusion Fittings: Comply with ASTM D2683.

G. Electrofusion Fittings: Comply with ASTM F1055.

2.9 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Adhesive for HDPE Conduit:
   1. Specifically designed for bonding dissimilar materials in lieu of transition fittings, including but not limited to polyethylene, fiberglass, PVC, aluminum, and steel; UL 746C recognized.
   2. Approved by adhesive manufacturer for use with materials to be joined.
   3. Adhesive Shear Strength: Not less that 100 psi, when tested in accordance with ASTM D1002.
   4. Hydrostatic Pressure Resistance: No leaks, when tested in accordance with ASTM D1598 at 120 psi for 1,000 hours and when tested in accordance with ASTM D1599 at 250 psi.
   5. Products:
      a. American Polywater Corporation; Polywater BonDuit Conduit Adhesive: www.polywater.com/#sle.

E. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

F. Foam Conduit Sealant:
   1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Rated to hold minimum of 10 ft water head pressure.
   4. Products:
      a. American Polywater Corporation; Polywater AFT Foam Duct Sealant: www.polywater.com/#sle.
      b. American Polywater Corporation; Polywater FST Foam Duct Sealant: www.polywater.com/#sle.

G. Conduit Mechanical Seals:
   1. Listed as complying with UL 514B.
   2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   3. Suitable for sealing around conductors/cables to be installed.
   4. Products:

a. American Polywater Corporation; PHRD SG Mechanical Seals: www.polywater-haufftechnik.com/#sle.

H. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

I. Sealing Systems for Concrete Penetrations:
   1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
   2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
   3. Products:
      a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: www.polywater-haufftechnik.com/#sle.
      b. American Polywater Corporation; PHSD Mechanical Seals: www.polywater-haufftechnik.com/#sle.
      c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: www.polywater-haufftechnik.com/#sle.
      d. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

J. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
   1. Products:
      a. Alta Products, LLC; Sigrist Pipe Chase Housing, Curbs, and Exit Seals: www.altaproductsllc.com/#sle.
      b. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
      c. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

K. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
   1. Products:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

L. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle

M. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:
    a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

N. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.
1. Products:
    a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route exposed conduits:
    a. Across floors.
    b. Across top of parapet walls.
    c. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. For power conduits, arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
9. For low voltage conduits, arrange conduit to provide no more than the equivalent of two 90 degree bends between pull points.
10. Arrange conduit to provide no more than 150 feet between pull points.
11. Route conduits above water and drain piping where possible.
12. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
13. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
14. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
15. Group parallel conduits in same area on common rack.

G. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

H. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Provide metal escutcheon plates for conduit penetrations exposed to public view.
8. Install firestopping to preserve fire resistance rating of partitions and other elements.

J. Underground Installation:
1. Provide trenching and backfilling; see Section 31 23 16.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.

K. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Secure conduits to prevent floating or movement during pouring of concrete.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

M. Conduit Sealing:
   1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
      a. Where conduits enter building from outside.
      b. Where service conduits enter building from underground distribution system.
      c. Where conduits enter building from underground.
      d. Where conduits may transport moisture to contact live parts.
   2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
      a. Where conduits pass from outdoors into conditioned interior spaces.
      b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
      c. Where conduits penetrate coolers or freezers.
   3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.

N. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O. Provide grounding and bonding; see Section 26 05 26.

P. Identify conduits; see Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Floor boxes.

D. Underground boxes/enclosures.

E. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 27 26 - Wiring Devices:
   1. Wall plates.
   2. Access floor boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2017.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, floor boxes, and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

B. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit is used.
   4. Use suitable concrete type boxes where flush-mounted in concrete.
   5. Use suitable masonry type boxes where flush-mounted in masonry walls.
   6. Use raised covers suitable for the type of wall construction and device configuration where required.
   7. Use shallow boxes where required by the type of wall construction.
   8. Do not use "through-wall" boxes designed for access from both sides of wall.
   9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
12. Gangable or sectional boxes shall not be permitted.
13. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
14. Wall Plates: Comply with Section 26 27 26.
15. Manufacturers:
    a. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

D. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover

bolts.

2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service. Covers shall read as follows for each system type:
   a. Power Systems: "ELECTRICAL"
   b. Site Lighting and/or Pole Lighting: "LIGHTING"
   c. Fire Alarm Systems: "FIRE ALARM"
   d. Other Low Voltage Systems: "COMMUNICATIONS"
5. Applications:
   a. Sidewalks/paved areas 6'-0" wide and smaller and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
   b. Parking Lots, Sidewalks/paved areas larger than 6'-0" wide, and in Areas Subject Only To Occasional Vehicular Traffic: Use reinforced concrete enclosures with galvanzed steel checker plate lids, with HS20-44 rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete and Reinforced Concrete Underground Boxes/Enclosures: Comply with SCTE 77 and HS20-44.
   a. Manufacturers:
      1) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
   b. Combination fiberglass/polymer concrete boxes/enclosures are not acceptable. Use all-polymer concrete boxes/enclosures.

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
   1. Manufacturers:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes so that wall plates do not span different building finishes.
   4. Locate boxes so that wall plates do not cross masonry joints.
   5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
   9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
   10. Outlet boxes shall be installed at the locations and elevations shown on the drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.

11. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.
12. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
13. Outlet boxes shall not be installed back to back nor shall through-wall boxes be permitted.
14. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.
15. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height with required location for equipment served.
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section 26 05 48.
3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use. Leave no unused openings in any box. Install close-up plugs as required to seal all openings and removed knockouts.

R. Provide grounding and bonding in accordance with Section 26 05 26.

S. Identify boxes in accordance with Section 26 05 53.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface raceway systems.

B. Wireways.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

D. Section 26 05 33.16 - Boxes for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 27 26 - Wiring Devices: Receptacles.

G. Section 27 10 00 - Structured Cabling: Voice and data jacks.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.

E. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 and conduit provided under Section 26 05 33.13 as required for installation of raceways provided under this section.
3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install raceways until final surface finishes and painting are complete.
   2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
   1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

B. Shop Drawings:
   1. Pre-wired Surface Raceway Systems: Provide plan and elevation views including dimensioned locations of wiring devices and circuiting arrangements.
   2. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.2 SURFACE RACEWAY SYSTEMS

A. General:

1. Surface nonmetallic raceway is to be utilized in dry interior locations only as covered in Article 352 Part B of the National Electrical Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute. The Raceway System shall be UL Listed under File Nos. E90378 Guide RJTX and E90377 Guide RJYT and CSA certified under File No. 350.
2. The raceway and all system components must be UL Listed and exhibit nonflammable self-extinguishing characteristics, tested to comparable specifications of UL 94V-0.

B. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.
   1. Multi-Compartment Raceway:
      a. Raceway:
         1) The raceway base, cover, and divider shall be available in 8' lengths. The system shall be manufactured of rigid PVC compound and have a smooth texture and white color.
         2) The raceway shall be a two-piece design with a base and snap-on cover. Total width shall be 6.68" x 1.75" deep with an approximate thickness of .10". The raceway shall be provided with three wiring channels formed by integral barriers in the base. The base shall have one wiring channel with integral ribs in the bottom to accept divider sections. Divider walls, which snap on the base forming separate channels.
         3) The base shall have three wiring channels separated by two integral barriers. Channels must accommodate standard power and communication devices without restricting capacity of adjacent channels. Barriers shall be removable to form one or two channels and divider walls must be available to replace removed barriers.
         4) The cover shall have flanges to snap-on the base. The divider shall have integral slots that snap-on the base after the integral barrier has been removed.
         5) Fiber Optic / Category Cable Radius Full Capacity Corners and Fittings: A complete line of full capacity corner elbows must be available to maintain a controlled 2" cable bend radius which meets the specifications for Fiber Optic and Category cabling and exceeds the TIA / EIA 569 requirements for communications pathways. Provide fittings as required. Fittings shall comply with this requirement regardless of type of wiring installed.
         6) A full compliment of fittings shall be available including but not limited to flat, internal and external elbows, tees, entrance fittings, cover clips, and end caps. They shall overlap the cover and base to hide uneven cuts and color matched to raceway base and cover. All fittings shall include a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other raceways.
      b. Device Brackets and Plates:

1) Device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall provide up to four single-gang openings at one location. Faceplates shall fit flush in the device plate.

c. Manufacturer:
1) Legrand Wiremold 5400 Series : www.legrand.us/#sle.

2.3 WIREWAYS

A. Manufacturers:
1. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com/#sle.
2. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

C. Wireway Type, Unless Otherwise Indicated:
1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.
2. Outdoor Locations: NEMA 250, Type 3R, painted steel with screw-cover; include provision for padlocking.

D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.

E. Minimum Wireway Size: 4 by 4 inches unless otherwise indicated.

F. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.4 SOURCE QUALITY CONTROL

A. Factory test each production unit for pre-wired surface raceway systems to verify proper wiring.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

E. Secure and support raceways in accordance with Section 26 05 29 at intervals complying with NFPA 70 and manufacturer's requirements.

F. Close unused raceway openings.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Identify raceways in accordance with Section 26 05 53.

I. Prior to and during installation, refer to system layout drawing containing all elements of the system. Installer shall comply with the detailed manufacturer's instruction sheets, which accompany system components, or the complete system instruction sheets, whichever is applicable. Install per CEC 352.

J. Raceway shall be cut to a smooth, even surface, without burrs or exposed sharp edges. System shall be mechanically continuous and connected to all electrical outlets, and conduits in accordance with manufacturers' instructions.

K. Provide labels showing circuit and panels numbers at each device per owner's requirements.

3.3 FIELD QUALITY CONTROL

A. Raceway shall be securely supported at intervals not exceeding 10 feet or in accordance with manufacturer's installation sheets.

B. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer's installation sheets. All unused raceway openings shall be closed.

C. Provide clear ¼ inch wide label with black, typed 11 point lettering on all receptacle faceplates showing panelboard name and circuit number supplying receptacle, unless otherwise noted.

D. Inspect raceways for damage and defects.

E. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.

F. Correct wiring deficiencies and replace damaged or defective raceways.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 05 48
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. Seismic restraint systems.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.3 DEFINITIONS

A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.4 REFERENCE STANDARDS

A. CBSC (California Building Standards Commission) - California Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, including all applicable amendments and supplements

B. CEC - California Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, including all applicable amendments and supplements

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

E. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

G. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

H. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.

I. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2015).

J. MFMA-4 - Metal Framing Standards Publication; 2004.

K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

L. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.6 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
   2. Seismic Controls: Include seismic load capacities.

B. Seismic Design Data:
   1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
      a. Component operating weight and center of gravity.
      b. Component elevation in the building in relation to the roof elevation (z/h).

c. Component importance factor (Ip).
d. For distributed systems, component materials and connection methods.
e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).

2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

C. Certification for seismically qualified equipment; identify basis for certification.

D. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

1.7 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.

1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.

4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation:
   1. Transformers:
      a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
      b. Floor-Mounted Transformers, Seismic Applications: Use seismic type restrained spring isolators.
      c. Suspended Transformers, Seismic Applications: Use seismic type spring isolator hangers.
      d. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.
      e. Minimum Static Deflection:
         1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
         2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
   2. Engine Generators:
      a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
      b. Seismic Applications: Use seismic type restrained spring isolators.
      c. Provide vibration-isolated concrete inertia bases where equipment is not designed to be point loaded.
      d. Minimum Static Deflection:
         1) Generators Mounted on Grade-Level Slabs: 1 inch deflection unless otherwise indicated.
         2) Generators Mounted at Above-Grade Levels: 2 inch deflection unless otherwise indicated.

E. Conduit Isolation:
   1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
      a. Minimum Length: 3 feet unless otherwise indicated.
   2. Vibration Isolators:
      a. Provide vibration isolators for conduit supports:

1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.
2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.

b. Minimum Static Deflection:
1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.

c. Suspended Conduits, Seismic Applications: Use seismic type spring isolator hangers.

d. Use modular seal where vibration-isolated conduits penetrate building elements (e.g. walls, floors) arranged to prevent vibration transmission to structure.

2.2 SEISMIC CONTROL REQUIREMENTS

A. Component Importance Factor (Ip): Electrical components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
1. Electrical components required to function for life safety purposes after an earthquake.
2. Electrical components that support or otherwise contain hazardous substances.

B. Seismic Qualification of Equipment:
1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

C. Premanufactured Modular Electrical Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

D. Seismic Restraints:
1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions:

a. Exemptions for Seismic Design Category D, E, and F:
    1) Discrete electrical components that are positively attached to the structure where either of the following apply:
        (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping, and conduit, and the component importance factor (Ip) is 1.0.
        (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
b. Conduit, Cable Tray, and Raceway Exemptions, All Seismic Design Categories:
    1) Raceways with component importance factor (Ip) of 1.0 where flexible connections are provided between cable tray or raceway and associated components, where cable tray or raceway is positively attached to the structure, and where one of the following apply:
        (a) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
        (b) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds or less.
        (c) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
        (d) Hanger supported conduits, cable trays, or raceways with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.
    2) Conduits less than 2-1/2 inch trade size.
c. Lighting Exemptions, All Seismic Design Categories:
    1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between

luminaires and the structure or other nonstructural components.

2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.

3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
   a. ASHRAE (HVACA).
   b. FEMA 413.
   c. FEMA E-74.
   d. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
   c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
   e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
   f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
   g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
   h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
   i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved

by project Structural Engineer of Record.

j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

E. Seismic Attachments:
1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
a. Increase size of pad as required to comply with anchor requirements.
b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

F. Seismic Interactions:
1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

G. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.
b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
c. Design displacements at seismic separations.
d. Anticipated drifts between floors.

2.3 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
1. Vibration-Isolated Equipment Support Bases:

a. Mason Industries; BR Restrained Bridge Mounts: www.mason-ind.com/#sle.

B. Vibration-Isolated Structural Steel Bases:
1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

C. Vibration-Isolated Concrete Inertia Bases:
1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches.
3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete.

2.4 VIBRATION ISOLATORS

A. Manufacturers:
1. Vibration Isolators:
a. Mason Industries; BR Restrained Bridge Mounts: www.mason-ind.com/#sle.

B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
a. Color code or otherwise identify springs to indicate load capacity.
b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Seismic Applications:
1. Resilient Material Isolator Mounts, Seismic:
a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing

in all directions.

2. Spring Isolator Hangers, Seismic:
    a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
    b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.5 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
    1. Seismic Restraint Systems:
        a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
        b. Eaton Corporation: www.eaton.com/#sle.
        c. Mason Industries: www.mason-ind.com/#sle.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:
    1. Comply with ASCE 19.
    2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
    3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
    4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.

1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Secure fasteners according to manufacturer's recommended torque settings.

E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Vibration Isolation Systems:
1. Vibration-Isolated Equipment Support Bases:
   a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
   a. Position equipment at operating height; provide temporary blocking as required.
   b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
   c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
   a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
   b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.

5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

G. Seismic Controls:
1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
   a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
   b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
   c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
   a. Size in accordance with seismic design to meet anchor requirements.
   b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
   a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
   b. Install restraints within permissible angles in accordance with seismic design.
   c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
   d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
1. Verify isolator static deflections.

2. Verify required clearance beneath vibration-isolated equipment support bases.
3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Seismic Controls:
1. Verify snubbing element air gaps.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Underground warning tape.
F. Floor marking tape.
G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
B. Section 26 05 36 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
C. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.
D. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
E. Section 26 31 00 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.
F. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).
B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
    1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
a. Switchboards:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
b. Panelboards:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Transformers:
    1) Identify kVA rating.
    2) Identify voltage and phase for primary and secondary.
    3) Identify power source and circuit number. Include power source location when not within sight of equipment.
    4) Identify load(s) served. Include load location when not within sight of equipment.
d. Enclosed switches, circuit breakers, and motor controllers:
    1) Identify voltage and phase.
    2) Identify power source and circuit number. Include power source location when not within sight of equipment.
    3) Identify load(s) served. Include load location when not within sight of equipment.
e. Time Switches:
    1) Identify load(s) served and associated circuits controlled. Include location.
f. Centralized Emergency Lighting Inverters:
    1) Identify input and output voltage and phase.
    2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
    3) Identify load(s) served. Include location.
g. Transfer Switches:
    1) Identify voltage and phase.
    2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
    3) Identify load(s) served. Include location when not within sight of equipment.
    4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
    5) Identify type of loads served (e.g. Required Emergency, Required Standby, Optional Standby)
h. Electricity Meters:
    1) Identify load(s) metered.
    2) Unique meter identifier, use identification label.

2. Service Equipment:
    a. Use identification nameplate to identify each service disconnecting means.
    b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format

and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
   b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
   c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
4. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
6. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
8. Use field-painted floor markings or floor marking tape to identify required equipment working clearances.
9. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
   a. Service equipment.
   b. Industrial control panels.
   c. Motor control centers.
   d. Elevator control panels.
10. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
11. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
12. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has

feeders or branch circuits served by more than one nominal voltage system.

3. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C. Identification for Raceways:
   1. Use voltage markers to identify highest voltage present for accessible conduits 2 inch (53 mm) trade size and larger at maximum intervals of 20 feet.
   2. Use factory-painted conduits or field painted conduits to identify systems other than normal power system for accessible conduits. Refer to section 26 05 33.13 for color coding and additional requirements.
   3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
   4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
   5. Use underground warning tape to identify underground raceways.

D. Identification for Cable Tray: Comply with Section 26 05 36.

E. Identification for Boxes:
   1. Use voltage markers to identify highest voltage present.
   2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
      a. For exposed boxes in public areas, use only identification labels.
   3. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:
   1. Identification for Communications Devices: Comply with Section 27 10 00.
   2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
   3. Use identification label to identify fire alarm system devices.
      a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
   4. Use identification label to identify serving branch circuit for all receptacles.
   5. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

G. Identification for Luminaires:
   1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

H. Identification for Photovoltaic Systems: Comply with Section 26 31 00

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
a. Brimar Industries, Inc: www.brimar.com/#sle.
b. Seton Identification Products: www.seton.com/#sle.
2. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
a. Brady Corporation: www.bradyid.com/#sle.
b. Brother International Corporation: www.brother-usa.com/#sle.
c. Panduit Corp: www.panduit.com/#sle.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
a. System designation where applicable:
1) Emergency Power System: Identify with text "EMERGENCY".
2) Standby Power System: Identify with text "STANDBY"
3) Fire Alarm System: Identify with text "FIRE ALARM".
b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:

a. System Designation: 1 inch.
b. Equipment Designation: 1/2 inch.

5. Color:
a. Normal Power System: White text on black background.
b. Emergency Power System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.

2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 73
POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26 24 16 - Panelboards.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).

B. NEMA MG 1 - Motors and Generators; 2021.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 70E - Standard for Electrical Safety in the Workplace; 2021.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.5 SUBMITTALS

A. Study preparer's qualifications.

B. Field testing agency's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
   1. Include characteristic time-current trip curves for protective devices.
   2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   3. Include documentation of listed series ratings upon request.
   4. Identify modifications made in accordance with studies that:
      a. Can be made at no additional cost to Owner.
      b. As submitted will involve a change to the contract sum.

E. Field quality control reports.

F. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

G. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of new electrical distribution system.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in

system modeling.

a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
   1) Obtain up-to-date information from Utility Company.
   2) Utility Company: Pacific Gas and Electric (PG&E).
b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
e. Protective Devices:
   1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
   2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Study Reports:
   1. General Requirements:
      a. Identify date of study and study preparer.
      b. Identify study methodology and software product(s) used.
      c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
      d. Identify base used for per unit values.
      e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
      f. Include conclusions and recommendations.

1.7 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

1. Study preparer may be employed by manufacturer of electrical distribution equipment.
2. Study preparer may be employed by field testing agency.
3. Study Preparers:
    a. Pioneer Power Group: www.pioneerpwr.com/#sle.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
1. Products:
    a. EasyPower LLC: www.easypower.com/#sle.
    b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
    c. Power Analytics Corporation: www.poweranalytics.com/#sle.
    d. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Comply with Section 26 05 53.
2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    a. Include orange header that reads "WARNING" unless otherwise indicated.
    b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
    c. Include the following information:
        1) Arc flash boundary.
        2) Available incident energy and corresponding working distance.
        3) Site-specific PPE (personnel protective equipment) requirements.
        4) Nominal system voltage.
        5) Limited approach boundary.
        6) Restricted approach boundary.
        7) Equipment identification.
        8) Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

A. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

E. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
   1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Instructor: Representative of entity performing study.
   4. Location: At project site.

END OF SECTION

SECTION 26 05 83
WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 05 33.13 - Conduit for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 27 26 - Wiring Devices.

E. Section 26 28 16.16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.5 SUBMITTALS

A. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 28 16.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 27 26.

D. Flexible Conduit: As specified in Section 26 05 33.13.

E. Wire and Cable: As specified in Section 26 05 19.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 09 43
DIGITAL LIGHTING CONTROLS

DISTRIBUTED DIGITAL LIGHTING CONTROLS

1.1 GENERAL

A. SECTION INCLUDES
1. Distributed Digital Lighting Control System, including:
a. Digital Lighting and Plug Load Controls
b. Dimming Controls
c. On/Off Controls
d. Relay Panels
e. Emergency Lighting Control

1.2 RELATED WORK:

A. See the following specification Section for work related to the work in this section:
1. Lighting
2. LED Interior Lighting
3. Lighting Poles and Standards
4. LED Exterior Lighting
5. Emergency Lighting
6. Raceways for Communications Systems

1.3 STANDARDS AND CODES:

A. Work and materials shall be in compliance and according to the requirements of the latest revision of the following Standards and Codes:
1. CEC - California Electrical Code
2. NFPA 70 - National Electrical Code; National Fire Protection Association.
3. NEMA - National Electrical Manufacturers Association
4. FCC emission standards
5. UL - Underwriters Laboratories, Inc. Listings
6. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
7. UL 20 - General Use Switches, Plug Load Controls
8. UL 924 - Standard for Emergency Lighting and Power Equipment

1.4 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B. System shall conform to requirements of CEC [NFPA 70].

C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS:

A. As specified in Division 1 and Section 26 05 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   3. Storage and handling requirements and recommendations.
   4. Installation instructions.

C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
   3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
   4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
   1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
   2. Operation and Maintenance Manual:
      a. Include approved Shop Drawings and Product Data.
      b. Include Sequence of Operation, identifying operation for each room or space.
      c. Include manufacturer's maintenance information.
      d. Operation and Maintenance Data: Include detailed information on device programming and setup.
      e. Include startup and test reports.

1.6 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 WARRANTY:

A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

1.8 EXTRA MATERIALS:

A. Deliver extra sets of items for Owner's use in maintenance as follows:
   1. Occupancy Sensors: (1) of each type installed
   2. Switches: (1) of each type installed
   3. Room Controllers: (1) of each type installed
   4. Emergency Lighting Control Units: (1) of each type installed

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer: Wattstopper or approved equal.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM:

A. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
   1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
   3. Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
   4. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   5. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
   6. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or

dimming control.

7. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
8. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
9. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
10. Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
11. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
12. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.
13. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

2.3 LOCAL NETWORK LMRJ-SERIES: DLM LOCAL NETWORK IS A FREE TOPOLOGY LIGHTING CONTROL PHYSICAL CONNECTION AND COMMUNICATION PROTOCOL DESIGNED TO CONTROL A SMALL AREA OF A BUILDING.

A. Features of the DLM local network include:
   1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   2. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
   3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital

devices in the local network.

4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

B. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

C. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.4 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD, AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
    a. Data transmission
    b. Device has power
    c. Status for each load
    d. Configuration status
5. Quick installation features including:
    a. Standard junction box mounting
    b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
    a. Turn on to 100 percent
    b. Turn off

c. Turn on to last level

7. Each load be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-off (Follow on and off)
   b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
   a. Load status
   b. Schedule state, normal or after-hours
   c. Demand Response enable and disable
   d. Room occupancy status
   e. Total room lighting and plug loads watts
   f. Electrical current
   g. Total watts per controller
   h. Total room watts/sq ft.
   i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
15. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
16. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
17. The following dimming attributes may be changed or selected using a wireless configuration tool:
   a. Establish preset level for each load from 0-100 percent
   b. Set high and low trim for each load
   c. Initiate lamp burn in for each load of either 0, 12 or 100 hours
18. Override button for each load provides the following functions:
   a. Press and release for on/off control
   b. Press and hold for dimming control
19. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound

dimming switches shall utilize this new maximum and minimum trim.

20. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
21. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
22. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. Plug Load Controllers shall include:
1. 120 VAC, 60 Hz rated for 20A total load. Controller carries application-specific UL 20 rating for receptacle control.
2. One relay configuration with additional connection for unswitched load
3. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
4. Factory default operation is Auto-on/Auto-off, based on occupancy
5. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
6. Switching power supply
   a. Simple 150mA - Only 4 100 series devices on a Cat 5e local network (LMPL-101)
   b. Smart 250mA (LMPL-201)
7. RJ-45 DLM local network ports
   a. Three RJ-45 ports (LMPL-101)
   b. Four RJ-45 ports (LMPL-201)
8. WattStopper product numbers:
   a. Plug Load Controllers: LMPL-101, LMPL-201.
   b. Wireless Transceiver and Receptacles: WRC-TX-LM, WRC-15-1/2, WRC-20-1/2

2.5 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Wall or ceiling mounted (to suit installation) passive infrared, ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square footage coverage requirements for each area controlled, utilizing Room Controller modules and accessories which suits the lighting and electrical system parameters.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and LCD entry for the following variables:

a. Sensitivity 0-100% in 10% increments
b. Time Delay – Fixed (1-30 minutes in 1 minute increments), and automatic
c. Test mode – Five second time delay
d. PIR, Ultrasonic or Dual Technology activation and/or re-activation.
e. Walk-through mode
f. Load parameters including auto/manual ON, blink warning, and daylight enable/disable.

2. One or two RJ-45 digital connections for DLM local network.
3. Two-way infrared communications port to allow remote programming through hand held commissioning tool.
4. Device Status LED's including:
   a. PIR Detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
6. Manual override of controlled loads.

C. Units will provide for digital calibration and commissioning and will not have any dip switches or potentiometers for field settings

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required

E. Manufacturer: The Watt Stopper LMPX, LMDX, LMPC, LMUC, LMDC or approved equal.

2.6 SINGLE / DUAL RELAY WALL SWITCH VACANCY SENSORS

A. Passive infrared sensing technology- Type PW: Manual ON, Automatic OFF Wall switch type passive infrared occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper PW-100, PW-200 PW-103, PW-203 or approved equal.

B. Ultrasonic sensing technology- Type UW: Manual ON, Automatic OFF Wall switch type ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper UW-100, UW-200 or approved equal.

C. Dual-tech (utilizing both passive infrared and ultrasonic) sensing technology- Type DW: Manual ON, Automatic OFF Wall switch type dual technology, passive Infrared and ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the

square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper DW-100, DW-200, DW-103, DW-203 or approved equal.

2.7 DIGITAL WALL SWITCHES:

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   3. Configuration LED on each switch that blinks to indicate data transmission.
   4. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
      d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
   5. Programmable control functionality including:
      a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
      b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
   6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Button state
   2. Switch lock control
   3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.

3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.8 DIGITAL DAYLIGHT SENSORS:

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
   1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
   2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
   3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone

B. Digital daylighting sensors shall include the following features:
   1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
   2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
   3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
   4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
   5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
   6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
   7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load

turns off. Selectable range between 0-240 minutes including option to never cut-off.

8. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
9. Configuration LED status light on device that blinks to indicate data transmission.
10. Status LED indicates test mode, override mode and load binding.
11. Recessed switch on device to turn controlled load(s) ON and OFF.
12. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints
    f. Operating mode - on/off, bi-level, tri-level or dimming
13. One RJ-45 port for connection to DLM local network.
14. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
15. Any load or group of loads in the room can be assigned to a daylighting zone
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
17. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

2.9 HANDHELD CONFIGURATION TOOLS:

A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
    1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. WattStopper Product Numbers: Handheld LMCT-100

2.10 DLM SEGMENT NETWORK

A. Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
3. Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
4. Network wire jacket is available in high visibility green, white, or black.
5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
7. Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable

B. WattStopper Product Number: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB

2.11 NETWORK BRIDGE:

A. Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
   1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
   2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
   3. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
      a. Read/write the normal or after hours schedule state for the room
      b. Read the detection state of each occupancy sensor
      c. Read the aggregate occupancy state of the room
      d. Read/write the On/Off state of loads
      e. Read/write the dimmed light level of loads
      f. Read the button states of switches
      g. Read total current in amps, and total power in watts through the load controller
      h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
      i. Activate a preset scene for the room
      j. Read/write daylight sensor fade time and day and night setpoints
      k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
      l. Set daylight sensor operating mode
      m. Read/write wall switch lock status
      n. Read watts per square foot for the entire controlled room

o. Write maximum light level per load for demand response mode
p. Read/write activation of demand response mode for the room
q. Activate/restore demand response mode for the room

4. WattStopper product numbers: LMBC-300

2.12 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER:

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:
1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:
a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
b. Individual terminal block, override pushbutton, and LED status light for each relay.
c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.

h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   a. Electrical:
   b. 30 amp ballast at 277V
   c. 20 amp ballast at 347V
   d. 20amp tungsten at 120V
   e. 30 amp resistive at 347V
   f. HP motor at 120V
   g. 14,000 amp short circuit current rating (SCCR) at 347V
   h. Relays shall be specifically UL 20 listed for control of plug-loads
   i. Mechanical:
   j. Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
   k. Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
   l. Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
   m. Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 tnetworked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.

c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
e. Scheduled ON / OFF
f. Manual ON / Scheduled OFF
g. Astro ON / OFF (or Photo ON / OFF)
h. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
i. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
j. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
k. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
    a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
    b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
    c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
    d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
    e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of

201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.

f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
g. Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
h. Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
i. Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
j. Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
k. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
l. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)
m. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
n. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
    a. Use the same intelligence board as the LMCP relay panel.
    b. Shall not include relay driver boards or relays.

c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.

12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

B. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an

approximate city/state location.

7. WattStopper Product Number: LMCT-100

2.13 SEGMENT MANAGER:

A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external BACnet-to-IP interface routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the Drawings.

C. Operational features of the Segment Manager shall include the following:
   1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
   2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.
   3. Log in security capable of restricting some users to view-only or other limited operations.
   4. Segment Manager shall provide two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system, and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
      a. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
      b. Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the WattStopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager
      c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device

settings and operational parameters to be viewed and changed by the user.

d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.

e. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.

5. Capabilities using the Segment Manager's Dashboard Screens shall include:

a. A dynamic "tile" based interface that allows easy viewing of each individual room's lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x).Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles use three color coded energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. Tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.

b. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.

c. Ability to provide a simple time vs. power graph based on information stored in each Segment Manager's memory (typically two to three days' data).

6. If shown on the Drawings, Segment Managers shall be integrated into a larger control network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Segment Manager interface software with dedicated communication and networking capability, able to pull information automatically from each individual Segment Manager in the network. By using a Supervisor, information for individual Segment Managers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten after a few days because of Segment Manager memory limits.
7. Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D. Segment Manager shall support multiple DLM rooms as follows:
   1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
   2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).

E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, LM-SUPERVISOR, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.14 PROGRAMMING, CONFIGURATION, AND DOCUMENTATION SOFTWARE:

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.
   1. Additional parameters exposed through this method include but are not limited to:
      a. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
      b. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
      c. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
      d. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
      e. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.

f. Load control polarity reversal so that on events turn loads off and vice versa.
g. Per-load DR (demand response) shed level in units of percent.
h. Load output pulse mode in increments of 1second.
i. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

2. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
   a. Device list report: All devices in a project listed by type.
   b. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
   c. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
   d. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
   e. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
   f. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
   g. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.
3. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
   a. Set, copy/paste an entire project site of sensor time delays.
   b. Set, copy/paste an entire project site of sensor sensitivity settings.
   c. Search based on room name and text labels.
   d. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
   e. Filter by parameter value to search for product with specific configurations.
4. Network-wide firmware upgrading remotely via the BACnet/IP network.
   a. Mass firmware update of entire rooms.
   b. Mass firmware update of specifically selected rooms or areas.
   c. Mass firmware upgrade of specific products

B. WattStopper Product Number: LMCS-100, LMCI-100

2.15 EMERGENCY LIGHTING CONTROL DEVICES:

A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 EXECUTION

3.1 PRE-INSTALLATION MEETINGS:

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
2. Review the specifications for low voltage control wiring and termination.
3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:
1. Record minutes of the conference and provide copies to all parties present.
2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

3.2 DELIVERY, STORAGE, AND HANDLING:

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

3.3 PROJECT CONDITIONS:

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
2. Relative humidity: Maximum 90 percent, non-condensing.

3.4 PREPARATION:

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.5 INSTALLATION:

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
   1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
   2. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty.
   3. Low voltage wiring topology must comply with manufacturer's specifications.
   4. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.6 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
   1. Verify Class I and II wiring connections are terminated properly by validating system performance.
   2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
   3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
   4. Verify that the control of each space complies with the Sequence of Operation.
   5. Correct any system issues and retest..

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
   1. Date of test or inspection.
   2. Loads per space, or Fixture Address identification.
   3. Quantity and Type of each device installed
   4. Reports providing each device's settings.

3.7 DEMONSTRATION AND TRAINING:

A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
   1. Confirmation of entire system operation and communication to each device.
   2. Confirmation of operation of individual relays, switches, and sensors.
   3. Confirmation of system Programming, photocell settings, override settings, etc.
   4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.8 PRODUCT SUPPORT AND SERVICE:

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

N. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.
   5. Identify mounting conditions required for equipment seismic qualification.

C. Manufacturer's equipment seismic qualification certification.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Panelboard Keys: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE; _____: www.electrification.us.abb.com/#sle.

B. Eaton Corporation; _____: www.eaton.com/#sle.

C. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc; _____: www.usa.siemens.com/#sle.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
      c. Indoor or Outdoor where subject to directional water or severe corrosion (e.g. hose-down areas in kitchens or where subject to salt water): Type 4X
      d. Class 1, Division 1 (Groups A, B, C, or D) Locations: Type 7 or 8.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
      c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

L. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:
1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
b. Provide interchangeable trip units for circuit breaker frame sizes 600 amperes and larger.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide the following circuit breaker types where indicated:
a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.6 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive panelboards.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 6 inch high concrete pad.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26 05 26.

L. Install all field-installed branch devices, components, and accessories.

M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

P. Provide filler plates to cover unused spaces in panelboards.

Q. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Fire detection and alarm circuits.

R. Identify panelboards in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test AFCI circuit breakers to verify proper operation.

G. Test shunt trips to verify proper operation.

H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.2 RELATED REQUIREMENTS

A. Section 26 05 33.16 - Boxes for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g, with Amendment.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings. Switches shall be located on the strike side of the door, unless otherwise noted, and shall not be obstructed by the door when it is in the open position.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Operation and Maintenance Data:
1. GFCI Receptacles: Include information on status indicators.

D. Project Record Documents: Record actual installed locations of wiring devices.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
2. Extra Wall Plates: One of each style, size, and finish.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in dwelling units, kindergarten classrooms, and daycare facilities.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

2.2 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.

C. Wiring Devices Installed in Finished Spaces : White with stainless steel wall plate.

D. Wiring Devices Installed in Unfinished Spaces: White with galvanized steel wall plate.

E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

2.3 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.4 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.5 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

F. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

G. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
   1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

O. Identify wiring devices in accordance with Section 26 05 53.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 05 73 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

C. Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fuses: One set(s) of three for each type and size installed.
2. Fuse Pullers: One set(s) compatible with each type and size installed.
3. Spare Fuse Cabinet Keys: Two.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

2.2 APPLICATIONS

A. General Purpose Branch Circuits: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

C. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

D. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class CC Fuses: Comply with UL 248-4.

I. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.4 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 26 05 53.

END OF SECTION

SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

F. Section 26 28 13 - Fuses.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Identify mounting conditions required for equipment seismic qualification.

C. Manufacturer's equipment seismic qualification certification.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual locations of enclosed switches.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
   2. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.

b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
1. Comply with NEMA KS 1.
2. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
a. Provide means for locking handle in the ON position where required.

P. Provide the following features and accessories where indicated or where required to complete installation:
1. Hubs: As required for environment type; sized to accept conduits to be installed.
2. Integral fuse pullers.
3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Provide required seismic controls in accordance with Section 26 05 48.

F. Install enclosed switches plumb.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Identify enclosed switches in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.
B. Emergency lighting units.
C. Exit signs.
D. Ballasts and drivers.
E. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.
B. Section 26 05 33.16 - Boxes for Electrical Systems.
C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
D. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).
B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.
G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
H. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.
I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).
J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.

C. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

D. Field quality control reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.

H. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide five year manufacturer warranty for LED luminaires, including drivers.

B. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

C. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

J. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
   1. Self-Powered Exit Signs:

a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.4 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.5 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D. Fire-Rated Luminaire Enclosures:
1. Manufacturers:
a. Fire Rated Product Specialties Corp: www.frpsonline.com/#sle.
b. Specialty Products & Insulation (SPI); SafeLite: www.spi-co.com/#sle.
2. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Provide required seismic controls in accordance with Section 26 05 48.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

I. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Poles and accessories.

D. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

E. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.

F. Section 26 28 13 - Fuses.

1.3 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2017.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).

C. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

D. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

E. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

F. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

G. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

H. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2021.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

J. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

K. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.

L. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution.
   3. Provide structural calculations for each pole proposed for substitution.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

C. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

D. Field Quality Control Reports.
   1. Include test report indicating measured illumination levels.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.

H. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 WARRANTY

A. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

J. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

K. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

2.3 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.4 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Material: Steel, unless otherwise indicated.
   3. Shape: Square straight, unless otherwise indicated.
   4. Finish: Match luminaire finish, unless otherwise indicated.
   5. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   6. Unless otherwise indicated, provide with the following features/accessories:
      a. Handhole, 3" x 5" in size.
      b. Anchor bolts with leveling nuts or leveling shims.
      c. Anchor base cover.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.5 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Provide required seismic controls in accordance with Section 26 05 48.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Pole-Mounted Luminaires:
   1. Foundation-Mounted Poles:
      a. Install foundations plumb.
      b. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
      c. Tighten anchor bolt nuts to manufacturer's recommended torque.
      d. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
      e. Install anchor base covers as indicated.
   2. Embedded Poles: Install poles plumb as indicated.
   3. Grounding:

a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.

4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.6 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the common administration basic requirements and common methods for all low voltage systems installation work included under Division 27 and 28 and where those requirements differ from the requirements of this section, the more stringent shall govern.

1.02 STANDARDS, REGULATIONS, AND CODES REFERENCES

A. The following Standards, Regulations and Codes apply to work specified in the Contract Documents.

1. Applicable State and Local Codes.
2. California Building Code and California Electrical Code, Current Editions.
3. BICSI TDMM (Telecommunications Distribution Methods Manual), 11th Edition 2006.
4. ANSI/TIA/EIA-568-B.1. Commercial Building Telecommunications Cabling Standard,
5. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 2, Grounding and Bonding Specifications for Screened Balanced Twisted-Pair Horizontal Cabling.
6. ANSI/TIA/EIA-568-B.1-3. Commercial Building Telecommunications Cabling Standard.
7. ANSI/TIA/EIA-568-B.1-4. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 4, Recognition of Category 6 and Category Cat 6A and 50 nm Laser-Optimized 50/125 um Multimode Optical Fiber Cabling.
8. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
9. ANSI/TIA/EIA-568-B.2-1. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 1,Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.
10. ANSI/TIA/EIA-568-B.2-10 (draft 2.0). Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 10, Transmission Performance Specifications for 4-Pair 100 Ohm Augmented Category 6 Cabling.
11. ANSI/TIA/EIA-568-B3.3 Optical Fiber Cabling Components Standard.
12. TIA-569-B. Commercial Building Standard for Telecommunications Pathways and Spaces.
13. ANSI/TIA/EIA-606-A. Administration Standard for Commercial Telecommunications Infrastructure.

14. ANSI/TIA/EIA-607-A. Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
15. TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
16. TIA/EIA TSB-72 Centralized Optical Fiber Cabling Guidelines.

1.03 DEFINITIONS

A. The following is a list of abbreviations generally used in Divisions 27 & 28:
   1. ADA - Americans with Disabilities Act
   2. AHJ - Authority Having Jurisdiction
   3. ANSI - American National Standards Institute
   4. APWA - American Public Works Association
   5. ASTM - American Society for Testing and Materials
   6. CBC - California Building Code
   7. CEC - California Electrical Code
   8. CFC - California Fire Code
   9. FCC - Federal Communications Commission
   10. HVAC - Heating, Ventilating and Air Conditioning
   11. IEC - International Electro-technical Commission
   12. IEEE - Institute of Electrical and Electronics Engineers.
   13. IETA - International Electrical Testing Association
   14. FM - FM Global
   15. NEMA - National Electrical Manufacturers Association
   16. NFPA - National Fire Protection Association
   17. OSHA - Occupational Safety and Health Administration
   18. UL - Underwriters Laboratories Inc.

B. Provide: To furnish and install, complete and ready for the intended use.

C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly, and installation.

D. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at the project site to complete items of work furnished by others.

E. Following is a list of commonly used terms in Division 27:
   1. Active Equipment: Electronic equipment used to develop various WAN and LAN services.

2. Backbone: Collective term sometimes used to describe the campus and vertical distribution subsystem facilities and media interconnecting service entrances, communications rooms, and communications cabinets.
3. Bonding: Permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to safely conduct currents likely to be imposed on it.
4. Cabinet: Wall-mounted modular enclosure designed to house and protect electronic equipment.
5. Cable Tray: Vertical or horizontal open supports, usually made of aluminum or steel, that are fastened to a building ceiling or wall. Cables are laid in and fastened to the trays. A cable tray is not a raceway.
6. Campus: Grounds and buildings of a multi-building premises environment.
7. Channel: The end-to-end transmission path between two points at which application specific equipment is connected; may include one or more links, cross-connect jumper and/or patch cords, and work area station cords. Does not include connection to active equipment.
8. Cross-Connect: Equipment used to terminate and tie together communications circuits.
9. Cross-Connect Jumper: A cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.
10. Fiber Optic Distribution Unit (FDU): Cabinet with terminating equipment used to develop fiber optic cross-connect facilities. Also known as LIU.
11. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
12. Hinged Cover Enclosure: Wall-mounted box with a hinged cover that is used to house and protect electrical devices.
13. Horizontal: Pathway facilities and media connecting the MDF or IDF to Telecommunications Outlets.
14. Intermediate Distribution Frame (IDF): Data networking equipment rack and/or location that serves an individual area, floor or building. Downstream from the MDF.
15. Jack: Receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.
16. Link: A transmission path between two points, not including terminal equipment, work area cables, and equipment cables; one continuous section of conductors or fiber, including the connecting hardware at each end.
17. Local Area Network (LAN): Data transmission facility connecting several communicating devices, typically Ethernet and the network is limited to a single campus.
18. Main Distribution Frame (MDF): Initial (main) data network equipment rack and/or location. Only one MDF occurs per site and may serve many downstream IDFs.
19. Media: The type of cable (e.g., twisted-pair, coaxial, or fiber optic) used to provide signal transmission paths.

20. Minimum Point of Entry (MPOE): The location where the service provider hands off connection and responsibility for service to on premise customer owned equipment.
21. Modular plug: An eight-position, eight-conductor end-of-wire electrical connector used with Category rated cable.
22. Passive Equipment: Non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, wiring blocks, FDUs, etc.
23. Patch Cord: A length of copper or fiber cable with connectors on both ends used to join communications circuits at MDF/IDF and end stations.
24. Patch Panel: System of terminal blocks or connectors used with patch cords that facilitate the administration of cross-connect fields.
25. Pathway: Facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, underfloor systems, raised floor, ceiling support wires, etc.
26. Protectors: Electrical protection devices used to limit foreign voltages on metallic communications circuits.
27. Raceway: An enclosed channel designed expressly for holding wires or cables; may either conductive metal or insulating plastic. The term includes conduit, tubing, wireway, underfloor raceway, and surface raceway; does not include cable tray.
28. Rack: An open or enclosed structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack. Maybe freestanding and floor mounted or a wall mounted cabinet. Industry standard 19" width spacing.
29. Wiring Block: Punch down terminating equipment used to develop twisted pair cross-connect facilities.

1.04 PRODUCT AVAILABILITY

A. Products with long lead times are to be brought to the attention of the project manager.

1.05 PRODUCT SUBMITTALS

A. See Division 01 Submittals for more requirements

1.06 SUBSTITUTION LIMITATIONS

A. Equivalent product(s) may be considered for substitution for those products specified, however, the equivalent product(s) must be approved, and show demonstrated and documented equivalence to the product(s) specified. Documentation includes but is not limited to product samples, data sheets, and actual test data. The request for product substitution, and supporting documentation, must be submitted, in writing to the Project Manager/Designer.

B. See Division 01 Substitutions for more requirements

1.07 QUALITY ASSURANCE

A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.

B. Conform to the latest adopted version of the CBC with amendments by local AHJs.

C. Obtain and pay for electrical permits, plan review, and inspections from local AHJs.

D. Furnish products listed by UL or other testing firm acceptable to AHJ.

E. Conform to requirements of the serving electric, telephone, broadband and cable television utilities.

F. Contractor Qualifications:
1. Minimum of five years' experience in the design, installation, testing, and maintenance of low-voltage systems.
2. Maintain a local service facility which stocks spare devices and/or components for servicing systems.
3. Have performed successful installation and maintenance of at least three projects similar in scope and size. Be able to provide project references for these three projects, including scope of Work, project type, owner/user contact name and telephone number.
4. The contractor selected for this project must be certified by the manufacturer of the products and utilize these components for completion of work.
5. Holds and maintains a valid California C-7 or C-10 State Contractors License and can exhibit validity upon request.
6. A list of test equipment proposed for use in verifying the installed integrity of copper and fiber optic cable systems used.
7. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who will be assigned to this project.
8. A list of technical product training attended by the contractor's personnel that will install the specified manufacturer system.
9. List of Sub-Contractor(s) who will assist the contractor in the performance of this work.

1.08 SEQUENCING AND SCHEDULING

A. For the proper execution of the work, cooperate with other tradecrafts and contracts as needed.

B. To avoid installation conflicts, thoroughly examine the complete set of Contract Documents. Resolve conflicts with Project Manager/Designer prior to installation.

C. Prior to installation of communications cable to equipment requiring connections, examine the manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that the electrical characteristics detailed in the Contract Documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Project Manager/Designer.

1.09 SHOP DRAWINGS

A. Shop Drawings: When required by individual Specification Sections, provide shop drawings which include physical characteristics, electrical characteristics, device layout plans, point-to-point wiring diagrams for all connections, and the like. Refer to individual Specification Sections for additional requirements for the shop drawings.

1.10 WARRANTY

A. Provide an extended manufacturer’s warranty on the Backbone and Horizontal Communications systems as specified in other sections of Division 27.

1.11 CLOSE OUT DOCUMENTS

A. Final coordination drawings, with as-built information added, are to be submitted as record drawings at completion of project.

B. Record Drawings:
   1. Show changes and deviations from the Construction Drawings. Include written Addendum and change order items.
   2. Show exact routes of pathway facilities and service entrance conduits.
   3. Show the exact location of racks, cabinets, mounting frames and the like.

C. Operation and Maintenance Documentation: Provide copies of certificates of code authority acceptance, product data, guarantees, warranties, installation guides, maintenance guides and the like.

D. Inspection and/or testing: Submit testing reports for testing that was performed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide like items from one manufacturer, such as wire/cable, jacks, modular plugs, patch panels, equipment connection cords, wall plates, and the like. See individual sections for detailed information.

2.02 MATERIALS

A. Provide new electrical materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established. Indicated brand names and catalog numbers are used to establish standards of performance and quality.

B. Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide plenum rated cable in ceilings that are utilized as air return plenums.

C. Include special features, finishes, accessories, and other requirements as described in the Contract Documents regardless of the item's listed catalog number.

D. Provide incidentals not specifically mentioned herein or noted on Drawings, but needed to complete the system, in a safe and satisfactory working condition.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Construction Documents:
1. Drawings are diagrammatic with symbols representing communications equipment, outlets, and wiring.
2. Electrical symbols indicating wiring and equipment shown in the Contract Documents are included in the Contract unless specifically noted otherwise.
3. Examine the entire set of Drawings to avoid conflicts with other systems. Determine exact route and installation of communications wiring and equipment with conditions of construction.

3.02 INSTALLATION

A. Install communications equipment completely as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of the communications equipment, examine the instructions thoroughly. When requirements of the installation instructions conflict with the Contract Documents, request clarification from Project Manager/Designer prior to proceeding with the installation.

B. Do not install communications equipment in obvious passages, doorways, scuttles, or crawl spaces which would impede or block the passage's intended usage.

C. Do not install communications equipment in locations where it would obviously be subject to damage during normal usage.

3.03 FIELD QUALITY CONTROL

A. Tests: Conduct tests of equipment and systems to demonstrate compliance with requirements specified in Division 27 & 28. Refer to individual Specification Sections for required tests. Document tests and include in Closeout Documents.

3.04 CLEANING

A. Remove dirt and debris caused by the execution of the communications work.

B. Leave the entire communications system installed under this Contract in a clean, dust-free, and proper working order.

C. Vacuum clean interiors of new and modified electrical signal and communication equipment enclosures.

END OF SECTION

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies the basic materials and methods for all low voltage pathways installation work included under Division 27 and 28 and where those requirements differ from the requirements of this section, the more stringent shall govern.

B. This section adds refinements to Division 26 that apply to Communications and extra-low-voltage systems.

1.02 SCOPE

A. Materials and/or methods for the following.
1. Communication services
2. Grounding
3. Fasteners
4. Hangers and supports
5. Conduits/Backboxes/Raceways
6. Underground
7. Sleeves and penetrations

1.03 SUBMITTALS

A. Submittals shall be done in accordance with District submittal procedures, see Division 01 Submittals for requirements.

1.04 RELATED REQUIREMENTS

A. Division 07 – Thermal and Moisture Protection

B. Division 26 – Electrical

C. 27 00 00 – Communications Basic Requirements

1.05 REFERENCES

A. ANSI American Nation Standards Institute

B. NFPA 70 – National Electrical Code

C. UL Underwriters Laboratory

D. California Building Code (CBC)

E. California Electrical Code (CEC)

1.06 WARRANTY

A. Refer to Division 01 -– Warranties

PART 2 – PRODUCTS

2.01 All products used on this project shall bear the label and be approved by Underwriters Laboratories unless otherwise approved in writing by District.

2.02 FASTENERS

A. Mounting hardware and anchors recommended by the manufacturer of any material that shall be mounted to the building or structure.
   1. Sheet rock / drywall / wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
   2. Concrete / cinder block / solid masonry: Expanding compression type lag, expanding compression type bolt, expanding compression type, all-thread with nuts, or approved equal.
   3. Tile / Stucco / hollow masonry: Toggle bolts or approved equal.
   4. Wood: Lag screws, wood screws, or approved equal.
   5. Metal: Beam clamps, sheet metal screws, self-drilling screws or approved equal.

2.03 HANGERS AND SUPPORT

A. D-RINGS
   1. Commercial grade

B. J-HOOKS
   1. Panduit J-Pro

2.04 SURFACE RACEWAY

A. Existing: Match raceway already installed in facility, unless otherwise instructed in project documentation.
B. New: Wiremold 2300 and 5400 raceway systems are acceptable.

2.05 CONDUITS AND ACCESSORIES

A. CONDUITS
1. See Division 26 for requirements.

2. Conduit for Fire Alarm applications shall be red in color (non-accessible areas are excluded).

3. All new conduits shall be sized accordingly to achieve a 40% maximum fill ratio with initial cables installed.

4. Underground conduits shall be Schedule 40 PVC.

B. INNERDUCT
1. Orange corrugated HDPE (High Density Polythylene) Innerduct shall be used for fiber optic cable protection in interior locations.

2. Fabric multi-cell innerduct is approved for underground conduits 2” and larger.

C. FITTINGS:
1. See Division 26 for requirements.

2. Conduit bodies, condulets, “LBs”, pulling elbows, and any sharp bend fittings are strictly prohibited for communication Cat6A and fiber optic cables. Appropriate conduit sweeps are required.

D. PULL LINE
1. Minimum 1/8" diameter, or larger braided line of polypropylene or continuous fiber polyolefin. The minimum breaking strength of 1/8 in. line is 200 lbs.

2.06 BACKBOXES, JUNCTION BOXES AND FLOOR BOXES

A. Galvanized one-piece or welded pressed steel type. Boxes shall be at least 2-1/8" deep, 4" square for 1 or 2 gang devices, with device rings. Boxes mounted in wall or ceiling finishes shall be furnished with device rings to match wall surface depth. Provide blank cover for all boxes without fixture or device.

B. Provide blank cover for all surface boxes without a device, sized to match the surface box. No edge of a blank cover shall extend past the edge of a surface box.

C. Junction boxes, larger than 8", located indoors shall be hinged, NEMA-1 rated.

D. Junction boxes, larger than 8", located on exterior walls, or in wet or damp locations shall be hinged, NEMA-3R.

E. Junction boxes of any size located on rooftops (including canopy rooftops) shall be hinged, NEMA 4.

F. Provide and install tamper-proof screws for all exterior boxes.

G. Junction boxes used for Fire Alarm systems are to be red in color with red colored cover plates.

2.07 GROUND BOXES

A. See Division 26 and below for requirements.

B. Approved manufactures are Jensen, Christy or approved equal.

C. All ground boxes shall have metal traffic-rated lids with permanent factory markings of COMM or COMMUNICATIONS.

D. Minimum size is 17" x 30"

E. For AT&T service feeds the requirement is for 30"x48" Intercept Pullboxes. Jensen SKU 100020251/Mod # K304836AT was referenced by AT&T.

F. For Comcast - Christy B2436 at service tie in and B1730 as an inline pullboxes are acceptable.

2.08 PENETRATION SEALING

A. Firestopping: Provide UL Listed Firestopping materials for all penetrations through rated assemblies (walls / floors). See Division 07 for more information.

B. Draft stopping: Foam sealant for use around conduit penetrations (in non-rated assemblies) to prevent passage of air, smoke, and/or toxic gas. See Division 07 for more information.

C. Weatherproofing: Weatherproof sealant for use around conduit penetrations in exterior walls to prevent the intrusion of water. See Division 07 for more information.

2.09 GROUNDING BUS BAR

A. Copper bus bar 2"x10"x1/4" minimum size with stand-off brackets and insulators, pre-drilled and threaded mounting holes (hole qty. 12 or greater) for equipment grounding lug attachment.

PART 3 - EXECUTION

3.01 COMMUNICATION SERVICES

A. Install inground boxes, conduits, and terminal cabinets per service provider requirements.

3.02 GROUNDING

A. Ground fittings shall be UL approved for each application and installed and/or connected to system in accordance with current CEC Code requirements.

B. See Division 26 for additional requirements.

H. Install grounding bus bar per manufacturer's instructions and in each MDF and IDF.
C.
I. All network equipment, racks, cabinets, and pathways shall be bonded to the grounding bus bars as described in the TIA 607 series of standards.

3.03 HANGERS AND SUPPORTS

A. Install hangers and supports per manufacturer's written instructions.

B. Hanger spacing shall be 48" or less and within 12" of sleeves and/or junction/back boxes.

3.04 LOW VOLTAGE PATHWAY/RACEWAYS

A. EMT conduit may be used at following locations:
   1. In dry locations in furred spaces.
   2. In partitions other than concrete or solid masonry.

B. Rigid steel conduit and fittings shall be used for vertical risers and on all roofs, overhangs, walkways, canopies, or any other location exposed to direct weather.

C. Furnish and install pull lines in all unused (empty) conduits or raceways. All pull lines shall be permanently tagged with identification at both ends.

D. Install exposed conduit neatly, parallel to or at right angles to structural members. Maintain a minimum of 12 inches of clearance from steam or hot water pipes. All installed strut channel supports should allow for future conduit attachments. The width of strut channel to match the width of the closest attached junction box. See design document details for attachment requirements.

E. Supports: Support conduit with two-hole straps or strut channel where shown in design documents and/or specified. Single-hole straps are prohibited. Coordinate supports with architectural details. Secure to wood structure by means of bolts or lag screws, to metal by means of shallow self-tapping screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry or stucco by means of toggle bolts.

F. Spacing for all EMT and rigid steel conduit supports shall be as follows unless otherwise specified in design documents details:

1. Surface conduit spacing and supports and unless otherwise specified or shown on drawing details:
    a. EMT – Size 3/4″ to 2″ – 4′ maximum spacing (3 each supports per 10′ conduit length) and 12″ from each end of conduit at coupling, connector or 90-degree bend.

    b. Rigid steel – Size 3/4″ to 2″ – 4′ maximum spacing (3 each supports per 10′ conduit length) and 12″ from each end of conduit at coupling, connector or 90-degree bend.

G. If conduit is designated for low voltage use, no more than a total of 360 degrees of conduit bend radius will be allowed between pull boxes.

H. All junction boxes shall be connected to conduits using appropriate connecting hardware (i.e. box connectors).

I. Clean, prep and paint with white primer all exposed conduit, junction boxes, channel strut, fittings, and accessories.

J. Before pulling any conductors into an underground PVC conduit (new or existing), the conduit shall be first be proofed by pulling through a mandrel of a diameter ¼ in. smaller

than the conduit inside dia., followed by a swab of the same diameter as the conduit inside diameter.

K. Non-metallic raceway to be installed with mechanical fasteners only, do not remove adhesive tape backing.

L. Capping

1. Cap conduits during construction with manufactured seals. Swab out conduits before installing wires.

2. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of debris, attach pull string to cap.

M. Underground Conduit

1. Service provider conduits shall be:
   a. AT&T - 1-4" (fiber only) or 2-4" (fiber and copper)

   b. Comcast - 1-2"

2. #10 tracer wire or tracer tape is required for all underground Division 27 PVC conduits.

3.05 J-BOXES

A. Screws shall be used to attach boxes, and must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers.

1. Boxes shall be attached to metal studs with metal box hangers.

2. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.

B. Locate outlets at the following heights unless otherwise noted on Drawings, Specifications, current CBC or as required to meet ADA handicap requirements.

1. Data Outlets: Same height as electrical outlets

2. Telephone Wall Outlets: Above counter/backsplash height or at light switch height.

C. Low Voltage boxes shall be placed within 18" of electrical outlets.

D. For sound control, separate outlets on opposite sides of walls 16" minimum. Where outlets are less than 16" or in sound rated walls, seal airtight with fire rated sheet putty pads.

Fill gap between junction box and wall with acoustical sealant all around perimeter of junction box. Fill conduits larger than 1 1/4" with fire rated putty.

E. Installation of conduit and outlet boxes in fire-resistive walls, floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 713.

3.06 GROUND BOXES

A. To be installed per Division 26 requirements.

B. Provisions to be made for supporting cables from the box sides (i.e., j-hooks, d-rings)

C. Install a 30" x 48" for service provider AT&T at service tie-in location and/or a 24" x 36" for service provider Comcast at service tie-in location. If less than 360-degrees of bends and less than 200 feet it is acceptable to stub in to the MPOE directly. If greater for 360-degree for bends or 200 feet for length then additional in-line ground boxes are required (30" x 48" for AT&T, 17" x 30" for Comcast). See section Part 2 – Products for more information.

3.07 SLEEVES AND CONDUIT PENETRATIONS

A. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceways mounted to the same wall as the penetration provide a threaded conduit and secured in place with locking rings on both sides. Bend radius requirements shall be maintained where penetrations are made through the back of raceways; junction boxes with adequate depth shall be installed to comply with this requirement.

B. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceways not mounted to the same wall as the penetration, provide EMT conduit and secured in place with strut channel. Box connectors shall always be used to connect EMT to junction boxes and raceways.

C. All wire and cable passing through metalwork shall be sleeved with an appropriate grommet or bushing.

D. FIRE STOPPING
1. Seal all conduit penetrations through fire rated walls and floors fire and smoke tight in conformance with current CBC and current CEC. See Division 07 for more information.

E. DRAFT STOPPING

1. All non-fire rated walls must be draft stopped and sealed. Submit method to be used for approval by inspector and/or project manager. Mineral wool is one product that may be used. See Division 07 for more information.

F. WEATHER SEALING

1. All exterior penetrations shall be sealed watertight. The contractor shall use silicone rubber caulk or other approved methods and materials. Submit method and material with inspector and/or project manager. See Division 07 for more information.

3.08 CLEANING

A. Clean all work prior to concealing, painting, and acceptance. Performed in stages if directed.

B. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance.

C. Remove debris from inside and outside of equipment and enclosures.

3.09 FINAL DOCUMENT SUBMITTALS

A. See 27 00 00 for more information.

END OF SECTION

SECTION 27 10 00
STRUCTURED CABLING

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable Structured Cabling communications system. The system shall provide highly reliable and high-performance data communication from main distribution frame (MDF) through each intermediate distribution frame (IDF) to end points requiring fiber optics and/or copper cabling and associated equipment.

B. This section condenses sections 27 11 00 – Communications Equipment Room Fittings, 27 13 00 – Communications Backbone Cabling, 27 15 00 – Communications Horizontal Cabling and 27 16 00 – Communications Connecting Cords into one comprehensive section.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:
1. Contractor shall furnish and install all required components and accessories as outlined in the design documents for a complete and operable turn-key system.
2. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the standards and requirements prior to beginning work.
3. The Contractor shall furnish and install fire-treated ¾" (three quarter inch) plywood for the MDF room (all walls, from floor level to 8' high) and IDF locations (as required or indicated in the design documents).
4. The Contractor shall furnish and install a ground bus bar at the MDF and IDF rooms.
5. The Contractor shall furnish and install all required racks and cabinets.
6. The Contractor shall install owner-provided uninterruptable power supply(ies) (UPS) for the MDF and/or IDF racks.
7. The Contractor shall furnish and install all newly required conduit/raceway.
8. The Contractor shall furnish and install all wire/cable (copper/fiber optic) as required.
9. The Contractor shall terminate all strands of fiber at each fiber enclosure.
10. The Contractor shall furnish and install termination all end-point equipment (patch panels, jacks, wallplates, enclosures, etc.).
11. The Contractor shall furnish and install all patch cords (copper/fiber).
12. The Contractor shall test and certify (for warranty) the installed cable plant.

1.03 RELATED REQUIREMENTS

A. Section 01 – General Requirements

B. Section 27 00 00 – Communications

C. Section 27 05 00 – Common Work Results for Communication Systems.

1.04 INDUSTRY GUIDELINES AND STANDARDS

A. California Electrical Code (CEC) – Current adopted version

B. California Building Code (CBC) – Current adopted version.

C. ANSI/TIA-568.0-D – Generic Communications Cabling for Customer Premises.

D. ANSI/TIA-568.1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.

E. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards

F. ANSI/TIA 568.3-D – Optical Fiber Cabling Components Standard

G. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.

J. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.

K. ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.

1.05 QUALIFICATIONS

A. The contractor shall possess a California C7 or C10 license.

B. The Contractor or Subcontractor shall have 5 years' documented experience.

C. The Contractor and installers shall be certified by the product manufacturer.

D. Contractor shall be a current Panduit One Partner, Platinum, that has completed the Structured Cabling Deployment training (Panduit Certified Installer). A copy of the corporate Panduit manufacturer certification shall be included with all quotes/bids/proposals.

1. At least 30 percent of the technicians installing low-voltage copper systems on the job shall have a current Panduit Certified Copper Technicians certificate.
2. At least 30 percent of the technicians installing any Fiber Distribution Systems shall have a current Panduit Certified Fiber Technicians certificate.
3. Contractor Project Manager on site shall have completed the Panduit Structured Cabling Deployment training and hold certificates for both copper and fiber.

1.06 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

1.07 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

B. Shop Drawings shall be required for this section.

1.08 SUBMITTALS

A. See section 27 00 00 for requirements.

B. Submittals shall be required for this section.

1.09 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

C. Contractor shall provide a 25-year Panduit Certification Plus System Warranty on all copper and fiber installations.

1.10 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. See Appendix A at the end of this document for pre-approved materials.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. Contractor shall confirm all equipment part numbers with the Project Manager or District prior to ordering equipment and updating submittals as required.

D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory installation and operation.

E. Install mounting hardware and anchors as recommended by the Manufacturer of the equipment that requires mounting to the building or structure and adhere to all code requirements. See section 27 05 00 for requirements.

F. Product Availability
1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2.02 MANUFACTURERS AND PRODUCTS

A. See Appendix A at the end of this document for pre-approved materials.

B. Substitutions require proof of equivalence and approval by District and/or its representative.

C. For maintenance and consistency with the existing installed base, data connectivity components (copper and fiber) shall be Panduit.

2.03 COPPER/FIBER OPTIC CABLES AND COMPONENTS

A. All copper cables and components shall be Cat6A rated.
   1. Cable to be reduced diameter, blue jacket.
   2. Jacks to be keystone style.

B. Data jacks system/color:
   1. Data = Blue color
   2. AP = Green color
   3. CCTV = Purple color
   4. Clock/Intercom/BMS/HVAC/Lighting = Black color
   5. Access Control = Orange color
   6. Fire Alarm/Intrusion Alarm = Red color

C. Copper patch cable color: Black

D. 45 degree angled data jacks shall be utilized at raceway and flush box locations.

E. All fiber optic cables and components shall be single single-mode OS2 rated.

F. Fiber optic cable terminations shall be LC-Duplex style.

PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The components making up the structure cabling system shall only be installed by Contractors who are qualified to install, service and maintain the system.

B. Cable terminations (copper or fiber) shall be installed by manufacturer certified technicians.

C. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to job bidding. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for accurate bidding and performance of the Work.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.

B. The Contractor shall verify the availability of power where required.

3.04 SHOP DRAWINGS

A. The Contractor shall create "Shop Drawings" per section 27 00 00 for this section.

B. Submit drawings for review and approval by the Project Manager and/or Designer.

3.05 INSTALLATION

A. ENTRANCE FACILITIES

1. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.

2. Install underground or aerial pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

B. UNDERGROUND ENTRANCE PATHWAY

1. Install underground entrance pathway complying with Division 26.

C. EQUIPMENT RACKS, CABINETS, ENCLOSURES AND ACCESSORIES

1. Backboards:
   a. Shall be installed behind the rack or cabinet if the cabinet is not able to be directly attached to two vertical wall studs or blocking.
   b. Backboards shall be made of fire retardant or treated materials, squarely cut, and with sanded edges.
   c. Backboards shall be a minimum ¾" thick.
   d. The "FIRE RATED" stamp shall be visible.
   e. Backboards shall be fastened with ¼" lag bolt and washer, non-recessed, with maximum spacing of 18" into 2 vertical studs. 1-1/2" embedment.
   f. Visible portions (outside of cabinet) of Backboards shall be painted.

2. All data & voice communications racks and cabinets shall be anchored in accordance with manufacturer's specifications, project specifications and/or drawn details, to walls and floors and grounded to building ground grid (not to water pipes etc.).

3. Securely mount equipment cabinet and racks to the building structure. A proper quantity of support fasteners shall be utilized. Typically lag bolts for wood installations,

wedge anchors for concrete flooring. Submit data sheets for mounting fasteners for approval before installation. Mount equipment per DSA approved drawings/details.

4. Equipment cabinet mounted on or against walls will have 3-foot clearance in front of deepest component and accessible to rear for service.

5. MDF and all IDFs shall have at least one dedicated 208V 20-amp (L6-20R) receptacle.

6. Patch Panels: Mount patch panels into the cabinet/rack.

7. Cable Management: Secure the cable bundle(s) to the rack strain relief and cable management behind the patch panels and cross connect block panels. Install horizontal cable management panels and brackets for routing and management of patch cables. Maintain TIA/EIA and BICSI standards on bundling, supporting and bend radius.

8. Surge Protected Outlet Strips: Required in MDF rack. Mount surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.

9. Install owner-provided UPS in MDF/IDF racks per design documents.

D. MDF/IDF GROUNDING

1. Refer to Section 27 05 00 Grounding for more requirements.

2. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 6 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

3. Bond metallic equipment (including ladder rack) to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.06 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District' Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

3.07 WIRE/CABLE (COPPER/FIBER OPTIC)

A. Design, layout, size, and plan new cable runs as required.

B. All wire and cable passing through metalwork shall be sleeved by an approved grommet or bushing.

C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.

D. Neatly dress and tie (Velcro) all cabling.

E. UTP cabling shall conform to a 6-foot separation requirement from the main power panel, transformers, switchgear and/or starter motors adjacent to the MDF, IDF and termination locations.

F. Fiber optic cable shall be installed directly from the MDF to each IDF.

G. Orange corrugated HDPE (High Density Polythylene) Innerduct shall be used for fiber optic cable protection in all interior locations.

H. Spicing of fiber optic cable shall be done with fusion splices.

J. Maintain proper bend radius for all cable installations.

K. Do not exceed cable manufacturer's instructions for installation pull load. Any cable damaged by excessive pull force shall be replaced by the installing contractor.

3.08 LABELING

A. MDF/IDF - Identification number in large font on front of cabinet.

B. MDF, Fiber Optic LIU Ports – IDF number and room number

C. MDF/IDF, Copper Patch Panel – Panels labeled P1, P2, P3, etc., ports labeled with room number.

D. LAN Outlet – IDF number, patch panel number, patch panel port number.

E. Cables to be labeled both ends with unique identifiers and from/to location identifiers. For Copper Cat cable IDF number, patch panel number, patch panel port number.

F. T-bar ceilings shall have device labels attached next to the device for ceiling mounted equipment and at the tile for above ceiling equipment with device type and device ID points/IP address.

3.09 CONDUIT AND RACEWAY INSTALLATION

A. See Division 26 and section 27 05 00 for requirements.

B. Conduit bodies and any other sharp bend fittings are strictly prohibited for communications cabling (copper/fiber).

C. Install proper radius conduit sweeps where required.

3.10 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.

B. Submit the Record Drawings (as-builts) to District for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District when ready to perform a re-inspection of the installation.

F. Provide 25-year manufacturer's warranty/certification documentation for all copper and fiber cable plant installations.

3.11 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Wall Cabinet 26U, 30" Deep	Panduit	PZWMC2630W
Fan Kit for Wall Cabinet	Panduit	PZCFK
Ground Kit for Wall Cabinet	Panduit	PZWMCGK
Vertical Wall Cabinet 3RU/3RU	Panduit	WME3BL
Fan Kit for Vertical Wall Cabinet	Panduit	PZAEFAN
Ground Kit for Vertical Wall Cabinet	Panduit	WMEGK
Fiber Bracket for Vertical Wall Cabinet	Panduit	FWME1BL
19" Horizontal Cable Manager 1-RU	Panduit	NCMHF1
Patch Panel 24-port 1-RU (Black)	Panduit	CPPL24M6BLY
Patch Panel Cable Management Support Bar	Panduit	SRB19BLY
Faceplate, 2-port (White)	Panduit	CFPL2WHY
Faceplate, 4-port (White)	Panduit	CFPL4WHY
Surface Mount, 2-port (White)	Panduit	CBX2WH-AY
Faceplate, 1-port w/ phone hanger	Panduit	KWPY
Cat6A Cable, Plenum (Blue)	Panduit	PUP6AHD04BU-G
Cat6A Cable, Indoor/Outdoor (Black)	Panduit	PUO6AS04BL-G
Cat6A Cable, Outdoor (Black)	Panduit	PFO6X04BL-CEG
Cat6A Data Jacks (White)	Panduit	CJ6X88TGWH
Cat6A Data Jacks (Green)	Panduit	CJ6X88TGGR
Cat6A Data Jacks (Blue)	Panduit	CJ6X88TGBU

Cat6A Data Jacks (Yellow)	**Panduit**	**CJ6X88TGYL**
Cat6A Data Jacks (Black)	**Panduit**	**CJ6X88TGBL**
Cat6A Data Jacks Angled (White)	**Panduit**	**CJUDCAPBU-WH**
Cat6A Data Jacks Angled (Green)	**Panduit**	**CJUDCAPBU-GR**
Cat6A Data Jacks Angled (Blue)	**Panduit**	**CJUDCAPBU-BU**
Cat6A Data Jacks Angled (Yellow)	**Panduit**	**CJUDCAPBU-YL**
Cat6A Data Jacks Angled (Black)	**Panduit**	**CJUDCAPBU-BL**
Cat6A Patch Cord Slim (color to match jack)	**Panduit**	**UTP28X**
Fiber Optic LIU 1-RU	**Panduit**	**FRME1U**
Fiber Optic LIU 2-RU	**Panduit**	**FRME2U**
Fiber Adapter Panel (12 pair)	**Panduit**	**FAP12WBUDLCZ**
Fiber Optic Cable Single-Mode OS2, Indoor/Outdoor	**Panduit**	**FSLP924**
Fiber Optic Patch Cord, OS2 LC/LC 1 meter	**Panduit**	**F92ERQ1Q1SNM001**

END OF SECTION

SECTION 27 21 00
DATA COMMUNICATIONS NETWORK EQUIPMENT

PART I - GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable data network system. The system shall provide reliable and high-performance data communication throughout the site.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

Provide, coordinate, and install all required equipment and accessories as outlined in the design documents for a complete and operable system.

Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, utilities, construction equipment and machinery, transportation, and other facilities and services necessary for the proper execution, operation, and completion of a turn-key system to the District.

Data Communications Network Equipment: Includes, but is not limited to:
Routers
Firewalls
Networking Switches
Wireless Access Points
VoIP Phone Equipment
Uninterruptible Power Supplies (UPS)

1.03 RELATED REQUIREMENTS

A. Division 01 - General Requirements

B. Section 27 00 00 - Communications

C. Section 27 05 00 - Common Work Results for Communication Systems.

D. Section 27 10 00 - Structured Cabling

1.04 QUALIFICATIONS

A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five years' experience installing data network equipment and systems.

1.05 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data network infrastructure.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

B. Shop Drawings shall be required for this section.

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.

B. Submittals shall be required for this section.

1.08 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.09 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. See Appendix A at the end of this document for pre-approved materials.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation/operation.

D. Product Availability

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. The District's preferred manufacturer for:
1. Routers - Aruba
2. Firewalls - Aruba
3. Networking Switches – Aruba
4. Wireless Access Points - Aruba
6. UPS – N1C

B. Substitutions require proof of equivalence and approval by District and/or its representative.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing data network equipment before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to bidding for the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty

and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the Project Manager of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the Project Manager.

C. The Contractor shall coordinate with the District's Technology Services department for needed IP addresses at least 2 weeks prior to configuration/installation.

3.04 SHOP DRAWINGS

A. The Contractor shall create "Shop Drawings" per section 27 00 00.

3.05 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

3.06 PATHWAY AND EQUIPMENT INSTALLATION

A. Install all conduit and pathway per design documents. Refer to 27 05 00 for additional information/requirements.

B. Install all Cat6A cable per design documents. Refer to 27 10 00 for additional information/requirements.

C. Equipment to be installed per manufacturer's instructions.

D. Devices requiring PoE power shall be connected to a PoE switch in the MDF/IDF data rack – verify with Technology Services for available PoE power.

3.07 CONFIGURATION

A. Any information needed from the District for configuration of equipment (i.e. VLAN, etc.) needs to be requested in writing 2 weeks prior.

B. All equipment to be fully configured and tested for functionality by the Contractor prior to District acceptance testing.

3.08 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify the District of readiness to perform the formal Test & Inspection of the complete system by the District or its representative. Make all adjustments/changes required from District/representative review.

B. Submit the Record Drawings (as-builts) to District for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system and have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District when ready to perform a re-inspection of the installation.

3.10 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Network Switch (48G/4SFP+)	**Aruba**	**OFCI**
SFP+ Transceiver	**Aruba**	**OFCI**
SFP+ DAC Cable (1 meter)	**Aruba**	**OFCI**
Core Switch	**Aruba**	**OFCI**
Wireless Access Point (Indoor, Ceiling)	**Aruba**	**OFCI**
Wireless Access Point (Indoor, Ceiling, High Density)	**Aruba**	**OFCI**
Wireless Access Point (Outdoor)	**Aruba**	**OFCI**
Mount for indoor Wireless Access Point (ceiling)	**Aruba**	**S0J40A**
Mount for outdoor Wireless Access Point	**Aruba**	**R9H97A**
UPS (MDF and IDF)	**N1C**	**OFCI**

SECTION 27 51 23.50
EDUCATIONAL INTERCOM SYSTEMS

PART I - GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable Intercom/Public Address/Bell system. This system shall provide the ability to bi-directionally communicate with an individual room, broadcast to defined speaker zone(s) and ring bell tones on a predefined schedule. For sites that utilize IP clock/speaker combination devices, this section will supplant the use of section 27 53 13 Clock Systems.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Educational Intercom system to the District.

2. The contractor will coordinate with the District in writing for any needed information (i.e. IP addresses, etc.) 10 business days prior to the date the information is needed.

B. The District has standardized on the Informacast IP-based intercom system, utilizing Atlas IP endpoint hardware. The contractor shall be an authorized dealer for Atlas products. For existing construction, the contractor shall be a servicing dealer of the existing Intercom system.

C. For existing construction – provide and install all components and accessories to modify the existing system while maintaining code compliance and to seamlessly integrate the new components into the existing campus' system. Prior to beginning any work, the Contractor is responsible for identifying any existing system errors or faults and bring these issues to the attention of the District Project Manager.

D. The Contractor shall be responsible for furnishing and installing all pathway, cabling, terminations, signal terminal cabinets, backboard, mounts, and backboxes.

E. The Contractor shall be responsible for installing for District-provided and configured IP endpoint devices including speakers, clocks, console phones, and legacy system interface components.

F. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the inspector of record (IOR) and District or the District's representative.

G. The Contractor shall adjust any analog (25V) speaker levels to the appropriate level as determined in system testing.

H. Existing systems shall remain operable until the new system is accepted and approved by the District or the District's representative.

I. The Contractor shall complete all required project closeout documentation in a timely fashion.

1.03 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 27 00 00 - Communications

C. Section 27 05 00 – Common Work Results for Communication Systems.

E. Section 27 10 00 – Structured Cabling

1.04 REFERENCES

A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing intercom system when applicable.

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.
B. Submittals shall be required for this section.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.
B. Shop drawings are required for this section.

1.09 QUALIFICATIONS

A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five (5) years' experience installing educational intercom equipment.

C. The contractor shall possess a California a C7 or C10 license.

D. The Contractor or Subcontractor shall be Atlas authorized to provide and install equipment with 5 years documented experience.

1.10 CERTIFICATIONS

A. Installers shall be manufacturer certified.

1.11 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

F. Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. The approved manufacturers for the project are:
1. Control unit and related accessories: Informacast Fusion
2. Speakers: See Appendix A for different installation types
3. Wire, cable, and accessories: See Appendix A.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory installation and operation.

D. Product Availability

1. The Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. See Appendix A at the end of this document for pre-approved materials.

B. Substitutions require proof of equivalence and prior approval by District and/or it's representative before ordering.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified and certified by the manufacturer to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing educational intercom equipment before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's Project Manager of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's Project Manager.

C. Submit and receive approval for shop drawings prior to work commencement.

3.04 PATHWAY INSTALLATION

A. See Division 26 and Section 27 05 00 for requirements and more information.

B. Existing Construction:
   1. Refer to design documents.
   2. Surface raceway and components shall be Wiremold 2300.

3.05 EQUIPMENT INSTALLATION

A. Equipment to be wired and installed per manufacturer's instructions.

B. Installation shall be in accordance with applicable codes (i.e. NEC, NFPA 72) local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

C. Perform all Work as indicated in the Drawings and Specifications.

D. All low voltage cables shall be kept away from power circuits.

3.06 LABELING/SCHEDULES

A. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).

B. Label all analog speaker cables with port ID.

C. Label all analog speakers with speaker ID.

D. Label all IP speakers with MDF/IDF, patch panel and jack numbers.

3.09 CONFIGURATION

A. All equipment to be fully configured and tested for functionality prior to testing.

3.10 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.

B. Submit the Record Drawings (as-builts) to District for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District when ready to perform a re-inspection of the installation.

F. District or its representative to provide final sign-off for acceptance.

3.11 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

B. As-built drawings shall be required for this section.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Fusion Appliance **(Site Controller)**	**Informacast**	**OFCI**
Surface IP Clock/Speaker Combo **a. Clock/Speaker** **b. Backbox**	**Atlas**	**a. OFCI** **b. IP-SEST-SD**
Surface IP Speaker (Exterior) **a. Clock/Speaker** **b. Backbox**	**Atlas**	**a. OFCI** **b. IP-SEST-HVP**
Surface IP Speaker (Interior) **a. Clock/Speaker** **b. Backbox**	**Atlas**	**a. OFCI** **b. IP-SEST-SD**
Drop Ceiling IP Speaker	**Atlas**	**OFCI**
IP Console Phone	**Atlas**	**OFCI**

SECTION 27 51 26
ASSISTIVE LISTENING SYSTEMS

PART I - GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable Assistive Listening system. The system shall be provided in each assembly area, including conference and meeting rooms, in accordance with ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010 section(s) 216.10, 219, 706, and CBC section(s) 11B-216.10, 11B-219, 11B-706.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Assistive Listening system to the District.

2. The contractor will coordinate with the District in writing for any needed information (i.e. IP addresses, etc.) at least 2 weeks prior to date the information is needed.

B. The Assistive Listening System shall be FM (72 MHz) for large venue systems, and IR for classroom and portable systems.

C. Assistive Listening equipment: Includes, but is not limited to:
   a. Transmitters
   b. Receivers
   c. Earpiece/Neck loops
   d. Chargers
   e. Signs

D. Typical installation includes a transmitter with audio source input or microphone and portable rechargeable receivers with either neck loops or earpieces.

E. Permanently installed assistive-listening systems are required in areas if (1) they accommodate at least 50 persons or if they have audio-amplification systems, and (2) they have fixed seating. If portable assistive-listening systems are used for conference or meeting rooms, the system may serve more than one room. An adequate number of electrical outlets

or other supplementary wiring necessary to support a portable assistive-listening system shall be provided.

F. The minimum number of receivers to be provided shall be equal to 4 percent of the total number of seats, but in no case less than two. Twenty-five percent minimum of receivers provided, but no fewer than two, shall be hearing aid compatible.

G. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neck loops.

E. Classroom assistive listening systems shall be fully integrated with the classroom audio-visual system or mobile TV cart such that program audio is provided via the assistive listening system.

1.03 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 27 00 00 - Communications

C. Section 27 05 00 – Common Work Results for Communication Systems.

D. Section 27 10 00 – Structured Cabling

1.04 REFERENCES

A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing AV system

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

B. Shop drawings are required for this section.

1.09 QUALIFICATIONS

A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five (5) years' experience installing Assistive Listening/AV equipment systems.

1.10 CERTIFICATIONS

A. See section 27 00 00 for requirements.

1.11 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

F. Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturers – The District has standardized on Listen Technologies.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The contractor shall provide all components needed for complete and satisfactory installation and operation.

D. Product Availability

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. See Appendix A at the end of this document for pre-approved materials.

B. Substitutions require proof of equivalence and prior approval by District and/or its representative before ordering.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing electronic assistive listening equipment before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's Project Manager of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's Project Manager.

C. Submit and receive approval for shop drawings prior to work commencement.

3.04 PATHWAY INSTALLATION

A. See Division 26 and Section 27 05 00 for requirements and more information.

B. Existing Construction:
   1. Refer to design documents.
   2. Surface raceway and components shall be Wiremold 2300.

3.05 EQUIPMENT INSTALLATION

A. Equipment to be wired and installed per manufacturer's instructions.

B. BASE TRANSMITTER (provide 1 for each permanent sound system).

1. Provide base transmitter with rack mount kit. Install where specified in the sound equipment rack and connect to content source.
2. Install antenna where specified and cabling from the Base Transmitter to the antenna location.
3. Program the transmitter to an interference-free transmit frequency in coordination with any adjacent systems

C. RECEIVERS (provide a quantity equal to or greater than 4% of the total number of seats, but in no case less than 2)

1. Install rechargeable batteries, if applicable
2. Program receivers to the broadcast frequency of the Base Transmitter

D. SIGN

1. Provide Assistive Listening System sign per ADA requirements to indicate equipment available for the hearing impaired. Verify location with the architect prior to installation. Submit sample for approval. The sign shall include wording that states "Assistive-Listening System Available" and shall be posted in a prominent place at or near the assembly area entrance, or ticket booth window as applicable. Verify location with architect prior to installation. Assistive listening signs shall include the International Symbol of Access for Hearing Loss.

E. PORTABLE SYSTEMS

1. Contractor shall provide programming and configuration for each Assistive Listening System portable system to ensure interference-free operation between adjacent systems.

3.06 LABELING/SCHEDULES

A. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).

B. Cables shall be identified with a machine-printed tag identifying the system type, source or head end location, and destination location in all access points (i.e. junction boxes, ground boxes, MDF, IDF, etc.) and as they enter or exit and conduit pathway.

3.09 CONFIGURATION

A. All equipment to be fully configured and tested for functionality prior to testing.

3.10 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.

B. Submit the Record Drawings (as-builts) to District for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District when ready to perform a re-inspection of the installation.

F. The District or its representative to provide final sign-off for acceptance.

3.11 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Portable ListenIR System	Listen Technologies	LS-88-01

END OF APPENDIX
END OF SECTION

SECTION 28 05 00
GENERAL REQUIREMENTS FOR SAFETY AND SECURITY

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. The work of this Section consists of providing all required labor, supervision, materials and equipment (except equipment furnished by the Owner to be installed by the Contractor) to satisfactorily complete the work shown on the drawings and/or specified in all Sections of Division 28 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete and fully operating facility. The work shall include but not be limited to the following:
   1. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated electrical systems.

1.2 RELATED WORK:

A. This Section provides the basic Electrical Requirements which supplement the General Requirements of Division 1 and apply to all Sections of Division 28.

1.3 STANDARDS AND CODES:

A. All work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:
   1. California Building Code (CBC)
   2. California Electrical Code (CEC)
   3. California Fire Code (CFC)
   4. American National Standards Institute (ANSI) Publications:
      a. C2-02 National Electrical Safety Code
   5. Code of Federal Regulations (CFR):
      a. 29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)
   6. Electronics Industries Association (EIA)
   7. Institute of Electrical and Electronics Engineers (IEEE)
   8. National Electrical Testing Association (NETA):
      a. Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, Standard ATS
   9. National Electrical Manufacturers Association (NEMA)
   10. Occupational Safety and Health Act (OSHA) Standards
   11. State of California Public Utilities Commission:
      a. General Order 128 Rules for Construction of Underground Electric Supply and Communication Systems

B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.

C. Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Safety labeling and listing by other organizations, such as ETL Testing Laboratories, may be substituted for UL labeling and listing if acceptable to the Owner. Provide service entrance labels for all equipment required by the NEC to have such labels.

1.4 SUBMITTALS:

A. As specified in Division 1. Submit to the Engineer shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

B. Submittals are required for all items, regardless of whether they are furnished as specified or are substituted.

C. Information to be submitted includes manufacturer's name, trade name, equipment model number, nameplate data, equipment drawings including: size, layout dimensions and capacity, manufacturer's descriptive literature of cataloged products, diagrams, test data, and performance and characteristic curves as applicable. Furnish project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

D. If submittal information includes multiple products, items being submitted for approval shall be clearly identified and Items not to be used on the project shall be clearly marked out.

E. Organize submittals for equipment and items related to each specification section together as a package.

F. Submit submittal packages in digital PDF format.

1. Certificates of Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements that imply the item does not meet requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications;" or "equal or exceed the service and performance of the specified material." Certifications shall state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed

by the manufacturer's official, authorized to sign certificates of conformance.

G. Substitutions:
   1. The equipment included in the Contract Documents is used to establish standards of quality, utility, and appearance. Equipment which in the opinion of the Engineer is equal in quality, utility, and appearance will be approved as substitutions to that specified.
      a. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are approved by the Engineer prior to bidding.
   2. Substitutions will be accepted for review where there is a reasonable reason for the substitution. Reasonable reasons include:
      a. Cost savings to the owner. Include deductive change order with submittal.
      b. A product with features providing additional benefits to the end user.
      c. Improved finished environment / Lay out of the final installation.
      d. Delivery considerations.
      e. Owner's specific requests.
   3. Where items are noted as "or equal", a product of equal design, construction and performance will be considered.
   4. Any item proposed as a substitute shall be accompanied by the following:
      a. Drawings and/or data giving sizes, capacities, all pertinent test data, catalog cut sheets, product information, and all other necessary information required to substantiate that the product is equal or exceeds that specified.
      b. A summary sheet noting each performance characteristic noted in the specification section or elsewhere in the contract documents of the specified product and the corresponding performance characteristics of the proposed substitution. The summary sheet shall contain the following information:
         1) Reason for Substitution Request
         2) Pertinent Performance Characteristics
         3) Specified Product Values
         4) Substituted Product Values
         5) Any substitution request that does not include the above information shall be rejected.
         6) Refer to the end of this specification section for an example form to be used for substituted products. A Microsoft Word version of the form can be provided to the Contractor for their use upon request.
   5. Substitutions shall be equal, in the opinion of the Engineer, to the specified equipment. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted equipment to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions

shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Plans or Specifications.

6. Contractor shall be responsible for coordination of the substituted products with other trades. Provide all additional connectivity, equipment, increased wire/conduit size, installation hardware, testing, and other miscellaneous appurtenances as required for a complete and fully functional installation.
7. Only one substitution will be considered for each product specified.
8. Alternate manufacturers must be submitted for approval 10 days prior to bid date unless noted otherwise in Division 1.
9. The Contractor shall be responsible for all expenses in connection with the substitution materials, process, and equipment, including the effect of his/her substitution on him/her, his/her sub-Contractor's or other Contractor's work. No substitution shall be permitted without written authorization of the Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

H. Change Orders:
   1. Where a change to the contract documents would result in a credit due to the Owner or a value add change to the project, provide a detailed change order request for the Engineer to review.
   2. It shall be understood that the Engineer's review of costs associated with the change order shall not constitute approval of the change order or their associated costs. The Engineer's review shall be intended to assist the Owner in evaluating the costs associated with the change only. Final approval or rejection of the change order shall be at the discretion of the Owner.
   3. Change order requests shall include the following information:
      1) Description of the change
      2) Reference to the document or written direction to make the change:
         (a) In the case of design-team directed changes, reference the drawing/sketch number or RFI number.
         (b) In the case of Owner-directed changes, reference the email, memo, or other written direction from the Owner and provide a copy of the direction.
      3) Detailed cost breakdown for the change:
         (a) Line item for each material noting:
            (1) Material used (e.g. ¾" EMT)
            (2) Total quantity (e.g. 200lf)
            (3) Unit cost (e.g. $2/lf)
            (4) Total materials cost (e.g. $400)
            (5) Unit labor hours (e.g 6hrs/100lf)
            (6) Total labor hours (e.g. 12hrs)
            (7) Hourly rate (e.g. $90/hr)

(8) Total labor cost (e.g. $1,080
(b) Total labor hours for each position (e.g. Journeyman vs. Superintendent)
(c) Total materials cost
(d) Overhead
(e) Profit
(f) Total change order value (positive for value added changes, negative for credits)

I. Closeout Submittals:
1. As-built drawings: Submit As-Built Record documents as in accordance with section 3.05 below.
2. Cost analysis: Submit final cost information including original bid and any change orders broken down by system, material and labor costs (as applicable):
a. Fire Alarm System
b. Intrusion System
c. Surveillance System
d. Card Access System
3. Operation and Maintenance Manuals: Furnish O & M Manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 1. Electrical O & M Manuals shall include as a minimum:
a. Copies of equipment supplied on the project.
b. Instruction manuals including operation instructions and maintenance requirements/recommendations.
c. List of suppliers for all equipment with addresses and telephone numbers.
d. List of service support for all equipment with addresses and telephone numbers.
e. Copies of all test reports required in Division 28 specification sections.
f. Spare Parts: For each piece of equipment, submit a list of recommended spare parts. Include part numbers and the name, address, and telephone number of the supplier.
g. Other closeout documentation and test results as required under other sections of the specifications.
h. Provide in a single transmittal.
i. Warranty for all work, including contractor's general warranty.
j. All warranties begin as per the Contract, Division 1 or final acceptance of the Work by the Owner, Architect, Engineer, and Authority Having Jurisdiction, which ever is later:
1) Manufacturer's Warrantees and Guarantees that are longer than the base contract/specified amount are to be provided with the manuals.
2) The Contractor is responsible for all Warranty and Guarantee work whether or not the Manufacturer also Warrantees and Guarantees the

product.

1.5 CONTRACT DOCUMENTS:

A. Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for the installations:
   1. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
   2. All drawings and divisions of these specifications shall be considered as whole. This contractor shall report any apparent discrepancies prior to submitting bids.
   3. Should there be a conflict or discrepancy between the drawings and specifications, or between different drawings sheets, or between different specification sections, the most expensive option shall be required, at the discretion of the Engineer.

B. Drawings:
   1. The Drawings shall govern the general layout of the completed construction.
      a. Locations of equipment, inserts, anchors, panels, pullboxes, manholes, conduits, stub-ups, fittings, devices, and ground connections are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.
      b. The general arrangement and location of existing conduits, piping, apparatus, etc., is shown as existing on drawings or specified. The drawings and specifications are for the assistance and guidance of the contractor, exact locations, distances and elevations are governed by actual field conditions. Extreme accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by the Engineer.

1.6 COORDINATION:

A. Coordinate the electrical work with the other trades, code authorities, utilities and the Engineer:
   1. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.
   2. Coordinate does not mean to only send a Request For Information. Coordinate implies that the contractor is to take the lead in bringing all of the necessary organizations together to coordinate the work and to provide for the associated costs.

B. Where connections must be made to existing installations, properly schedule all the required work, including the power and system shutdown periods. Schedule and carry

out shutdowns so as to cause the least disruption to operation of the Owner's facilities:

1. Include costs for work during non-normal working hours and temporary facilities as may be required.
2. Include costs as necessary for sub-contractors to accomplish the specified work.

C. When two trades join together in an area, make certain that no electrical work is omitted. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.

D. Operations:
   1. Perform all work in compliance with Division 1:
      a. Keep the number and duration of power and system shutdown periods to a minimum.
      b. All shutdowns which would interfere with the operations of Owner's equipment or facilities shall be coordinated with the Owner a minimum of 15 days in advance.
         1) Where Owner's equipment or facilities must remain operational during the shutdown, provide sufficient means to temporarily backup the interrupted services for the duration of the interruption.
      c. Show all proposed shutdowns and their expected duration on the construction schedule.
         1) If the construction schedule is created and maintained by others, make sure that the associated information is incorporated.
         2) Failure by the Contractor to properly schedule and plan for such activities is not a basis for additional compensation.
      d. Carry out shutdown only after the Engineer has favorably reviewed the schedule. Submit power/communications interruption schedule 15 days prior to date of interruption. Failure to provide schedule with adequate review time may result in rescheduling of the work at the Contractor's expense.

E. Construction Power:
   1. See Division 1 Temporary Utilities.

F. Storage:
   1. Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from sun, weather, condensation, dust, water, or construction operations.

G. Damaged Products:
   1. Notify the Engineer in writing in the event that any equipment or material is damaged. Obtain approval from the Engineer before making repairs to damaged products.

H. Order material in such a timely manner and after approval of the same so as to insure that the approved material is available to be installed on site in a timely manner. Additional costs or substitutions necessitated because the Contractor failed to order

material in a timely manner are not reimbursable. Costs associated with processing of paperwork by the owner and design consultants resultant of such failures to coordinate the work by the Contractor shall have such costs reimbursed by the Contractor

1.7 LOCATIONS:

A. General:
1. Use equipment, materials and wiring methods suitable for the types of locations in which they are located:
a. Dry Locations:
1) All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
b. Wet Locations:
1) All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.

1.8 SAFETY AND INDEMNITY:

A. The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and properly during performance of the work. This requirement will apply continually and not be limited to normal working hours:
1. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
2. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants, and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the engineer, their Consultants or their officers, agents and employees.

PART 2 PRODUCTS

2.1 STANDARD OF QUALITY:

A. Material and Equipment:
1. Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.

B. Service Support:
   1. Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.

C. Manufacturer's Recommendations:
   1. Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.2 NAMEPLATES:

A. For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings, the model designation, and shop order number.

B. Additionally, identify each piece of equipment and related controls with a rigid laminated engraved plastic nameplate. Unless otherwise noted, nameplates shall be melamine plastic 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 1 by 2.5 inches unless otherwise noted. Where not otherwise specified, lettering shall be a minimum of 0.25 inch high normal block style. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel screws or, where favorably reviewed by the Engineer, with epoxy cement. Where no inscriptions are indicated on the Drawings, furnish nameplates with appropriate inscriptions furnished by the Engineer upon prior request by the Contractor.

2.3 FASTENERS:

A. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.4 FINISH REQUIREMENTS:

A. Equipment:
   1. Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which as been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B. In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

C. Conduits for fire alarm or life safety raceways shall be factory painted red along their entire length.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Ensure that all equipment and materials fit properly in their installation.

B. Perform any required work to correct improperly fit installation at no additional expense to the owner.

C. Equipment Installation:
   1. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
   2. Mount all metal panels which are mounted on or abutting concrete walls or any outside walls a minimum of ¼ inch from the wall, and paint the back sides of the panels with Bituminous Coating, Rust-oleum C9578 Coal Tar Epoxy Coating or approved equal. Film thickness shall be 10 mils minimum.

D. Cutting, Drilling and Welding:
   1. Provide the required cutting, drilling welding that is required for the electrical construction work. Comply with Division 1 requirements.
   2. Structural members shall not be cut or drilled, except after approval by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.
   3. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel. Where welding is required, it shall be accomplished by tradesmen certified to do such work. Provide fire and other protection as appropriate.

3.2 FIELD TESTS:

A. Test shall be in accordance with Acceptance Testing specifications issued by the National Fire Protection Association (NFPA) 72 Chapter 7 for fire alarm and manufacturer's recommendations for security systems.

B. Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all devices and components, and demonstrate as ready for service. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Engineer prior to any test so that the tests may witnessed.

C. Provide instruments, supplies, other equipment, temporary facilities as may be necessary and material required for the tests. Instruments shall be of the type designed for the type of tests to be performed and shall be calibrated by a recognized testing laboratory within three months prior to testing.

D. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions.

E. Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Engineer. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.

F. Perform calibration and adjustment on all equipment.

G. Maintain records of each test and submit five copies to the Engineer when testing is complete. All tests shall be witnessed by the Engineer. These records shall include:
   1. Name of equipment tested.
   2. Date of report.
   3. Date of test.
   4. Description of test setup.
   5. Identification and rating of test equipment.
   6. Test results and data.
   7. Name of person performing test.
   8. Owner or Engineer's initials.

H. Items requiring testing as a minimum:
   1. Fire Alarm System.
   2. Intrusion System.
   3. Surveillance System.
   4. Card Access System.

3.3 PAINTING OF EQUIPMENT:

A. Factory Applied:
   1. Electrical equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section. Fire alarm raceways shall be factory painted red.

B. Field Applied:
   1. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.4 SIGNAGE:

A. Nameplate Mounting:
   1. Provide number, location and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two stainless steel sheet-metal screws or two rivets.

3.5 RECORDS:

A. Maintain one copy of the contract Drawing Sheets on the site of the work for recording the record "as built" condition. After completion of the work, the Contractor shall neatly and carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:
   1. Drawings and associated as-built changes shall be completed in AutoCAD or Revit and submitted in CAD/Revit as well as PDF format. Documents with hand-written changes or with RFI responses and field sketches pasted on shall not be acceptable. Engineer shall make digital backgrounds of original contract documents available for Contractor's use upon request.
   2. Cable Size and Type: Provide the size and type of each cable installed on the project.
   3. Substructure: Where the location of duct lines, adjacent utilities, cable boxes, and manholes are found to different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
   4. Record (As Built) Drawings: At the completion of the Work the Contractor shall provide a set of record "as built" drawings over to the Owner for his use:
      a. Record drawings are required to be transmitted within 30 days of beneficial occupancy.
      b. Transmittal and approval process:
         1) Contractor is to transmit one printed copy for review and comment.
         2) After acceptance of the above, the Contractor is to transmit three printed sets and one digital reproducible set.
         3) Contractor to provide information on their company in the margin of record drawings along with the date of the revisions and the associated revision number.

3.6 POSTED OPERATING INSTRUCTIONS:

A. Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:
   1. Single line diagrams, wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
   2. Start up, proper adjustments, operating, lubrication and shutdown procedures.
   3. Safety precautions.
   4. The procedure in the event of equipment failure, trouble or alarm.
   5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

3.7 INSTRUCTION TO OWNER'S PERSONNEL:

A. Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or systems has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for field instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

B. Contractor shall video record all training sessions and shall provide the Owner with a copy of the recording at the conclusion of the training. Recording shall be in digital video format (MP4, AVI, or similar) and shall be provided on USB stick or DVD labeled with the Contractor’s contact information, the training topic, and date of training.

C. Contractor shall maintain an attendance sheet from each session which contains the following information:
   1. Attendees with associated arrival and departure time.
   2. Topics covered.
   3. Information provided.
   4. Signatures of attendees taken at the completion of the session.

3.8 CLEAN UP:

A. Thoroughly clean all soiled surfaces of installed equipment and materials.

B. Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Engineer.

END OF SECTION

SECTION 28 05 13
WIRE AND CABLES FOR SAFETY AND SECURITY

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. The work of this Section consists of providing all wire and cable rated 600 volts or less, including splices and terminations, as shown on the Drawings and as described herein.

1.2 RELATED WORK:

A. See the following Specification Section for work related to the work in this Section:
   1. 28 05 00 General Requirements for Safety and Security Systems
   2. 26 05 33.13 Conduit for Electrical Systems
   3. 26 05 33.16 Boxes for Electrical Systems

1.3 STANDARDS AND CODES:

A. Work and materials shall be in compliance with and according to the requirements of the latest revision of the following Standards and Codes:
   1. American Society for Testing and Materials (ASTM):
      a. B3-01, Specification for Soft or Annealed Copper Wire
      b. B8-99, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft
      c. B173-01a, Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors
   2. Federal Standards (FED. STD.):
      a. 228, Methods of Testing Insulated Cable and Wire
   3. Federal Specifications (FS):
      a. A-A-59544, Cable and Wire, Electrical
      b. A-A-55809, Pressure Sensitive Electrical Plastic Insulation Tape
   4. National Electrical Manufacturers Association (NEMA):
      a. WC 70-1999/ICEA S-95-658-1999, Cross-Linked Thermosetting Polyethylene, Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
   5. California Electrical Code (CEC)
   6. National Electrical Code (NEC)
   7. Underwriters Laboratories (UL):
      a. 44-83 (R1988), Rubber-Insulated Wires and Cable
      b. 83-1983 (R1989), Thermoplastic-Insulated Wires and Cables
      c. 510-1986, Insulating Tape

1.4 SUBMITTALS:

A. As specified in Division 1 and Section 28 05 00.
   1. Catalog Data: Provide manufacturer's descriptive literature.

2. Single Submittal: A single complete submittal is required for all products covered by this Section.

PART 2 PRODUCTS

2.1 CONDUCTORS:

A. General:
1. Conductors shall be copper, Class B stranded and of the sizes indicated. All conductors 120 volts and above shall be in raceway unless otherwise noted. Minimum power and control wire size shall be No. 12 AWG unless otherwise specified by the Owner's Representative. All cable used on this Project shall be of the same type and conductor material.

B. Unless otherwise noted, conductors #6 and larger shall be XHHW insulation suitable for operation in wet or dry locations at temperatures not to exceed 75C in wet locations and 90C in dry locations. Conductors #8 and smaller shall be THHN in dry locations and THWN/THHN in wet locations. Control Cable shall be THHN.

C. Insulation Marking:
1. All insulated conductors shall be identified with printing colored to contrast with the insulation color.

D. Special Wiring:
1. Where special wiring is proposed by an equipment manufacturer, submit the special wiring requirements to the Owner's Representative and, if approved, provide same. Special wire shall be the type required by the equipment manufacturer.

E. Other Wiring:
1. Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and as approved by the Owner's Representative.

F. Terminations:
1. Cable Termination for Copper: Crimp style two hole NEMA spade terminals designed and rated for copper cable.
2. Wire Terminations: Crimp on ring-tongue terminals, insulated sleeve, of proper size for the wire used.
3. End Seals: Heat shrink plastic caps of proper size for the wire on which used.
4. Manufacturer: T&B, Burndy or approved equal.

G. Manufacturer: General Cable Inc., Southwire, or approved equal.

2.2 FIRE ALARM CABLES:

A. Addressable Loop Cables:
1. Verify recommended cable type with system manufacturer. Cable shall be minimum #14 shielded twisted pair, unless otherwise noted. Refer to drawings

and 28 31 00 Fire Alarm system for additional requirements:

a. Cable for all exterior, underground or wet locations shall be outdoor rated with water-blocked construction, sunlight and moisture resistance jacket.
   1) Manufacturer: #14ga - WestPenn AQ295 or approved equal
b. Cable for all interior areas shall be plenum rated cable.
   1) Manufacturer: #14ga - WestPenn 60992BS or approved equal

B. Notification Circuit Cables:
   1. Refer to section 2.1 Conductors for Notification Circuit Cables. Refer to drawings for size and quantity. Refer to Specification Section 28 31 00 - Fire Alarm System for additional requirements.

2.3 SECURITY CABLES:

A. Verify recommended cable type with system manufacturer. Cable shall be minimum #14 shielded twisted pair. Refer to drawings for additional requirements:
   1. Cable for all exterior, underground or wet locations shall be outdoor rated with water-blocked construction, sunlight and moisture resistance jacket.
      a. Manufacturer: #14ga - WestPenn AQ295 or approved equal
   2. Cable for all interior areas shall be plenum rated cable.
      a. Manufacturer: #14ga - WestPenn 60992BS or approved equal

2.4 TAPE:

A. Tape used for cable marking shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform to FS HH-I-595 and UL 510.

PART 3 EXECUTION

3.1 CABLE INSTALLATION:

A. Clean Raceways:
   1. Clean all raceways prior to installation of cables as specified in Specification Section 28 05 00 – Safety/Security System Raceways and Fittings.

B. Cable Pulling:
   1. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

C. Bending Radius:
   1. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length.

D. Equipment Grounding Conductors:

1. Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any conduit or any raceway.

E. Wiring at Hinges:
   1. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and arrange so that they will be protected from chafing when the hinged member is moved.

F. All wiring and cable shall be supported from the structure above. All wiring below 100 volts shall be installed in conduit unless otherwise noted.

G. Low Voltage Cables:
   1. All cables provided inside buildings shall be plenum rated.
   2. All cables provide outside buildings shall be outdoor rated, gel filled cables.
   3. All low voltage wires and cables concealed in walls shall be run in EMT conduit from flush outlet boxes to above accessible ceilings. Provide conduit where cables penetrate floors and fire walls above ceilings. Where low voltage cables run parallel to line voltage (over 120 volts), they shall be installed a minimum of 12 inches apart.

3.2 CABLE TERMINATIONS AND SPLICES:

A. Splices:
   1. All fire alarm and security cables shall be continuous below grade (i.e. no splices or terminations below grade).
   2. Use UL listed wirenuts for line voltage branch circuits in dry locations.

B. Terminations: Shall comply with the following:
   1. Make up and form cable and orient terminals to minimize cable strain and stress on device being terminated on.
   2. Burnish oxide from conductor prior to inserting in oxide breaking compound filled terminal.

3.3 FIELD TESTS:

A. The Contractor shall perform the following tests at his expense:
   1. Continuity Test of Wire:
      a. Test each wire for continuity and accuracy of the identifying tags at both ends and at all locations marked. Submit a report to the Owner's Representative certifying the fact of the test and the accuracy of the marking.
   2. Insulation Resistance Tests:

a. Perform insulation resistance tests on all wire and cable installed. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall be disconnected. Test the insulation with a 500 Vdc insulation resistance tester with a scale reading not less than 100 megohms. The insulation resistance shall be 2 megohms or more. Submit results for review.

END OF SECTION

SECTION 28 20 00

VIDEO SURVEILLANCE

PART I - GENERAL

1.01 SUMMARY

A. This section specifies software, equipment, accessories, wire, materials, installation, configuration, and testing requirements for a complete and operable Video Surveillance system. The system shall provide electronic recording/playback and monitoring of digital cameras installed at the site.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:
1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, wire, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Video Surveillance system to District.

1.03 RELATED REQUIREMENTS

A. Division 01 - General Requirements

B. Section 27 00 00 - Communications

C. Section 27 05 00 - Common Work Results for Communication Systems.

C. Section 27 10 00 - Structured Cabling

1.04 QUALIFICATIONS

A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five years' experience installing Video Surveillance equipment systems.

1.05 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing Video Surveillance system.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

B. Shop drawings are required for this section.

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.

B. Submittals are required for this section.

1.08 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.09 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. See Appendix A at the end of this document for pre-approved materials.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation/operation.

D. Product Availability

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. The District’s preferred manufacturer for CCTV equipment is Axis.

B. The District’s preferred manufacturer for video intercom is Aiphone.

C. Substitutions require proof of equivalence and approval by District and/or its representative.

D. All exterior cameras to be IP67 rated or better.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing Video Surveillance equipment before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to job bidding. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the Project Manager of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the Project Manager.

C. The Contractor shall coordinate with the District's Technology Services department for needed IP addresses at least 2 weeks prior to configuration/installation.

3.04 SHOP DRAWINGS

A. The Contractor shall create "Shop Drawings" per section 27 00 00.

3.05 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

3.06 PATHWAY AND EQUIPMENT INSTALLATION

A. Install all conduit and pathway per design documents. Refer to 27 05 00 for additional information/requirements.

B. Install all Cat6A cables per design documents. Refer to Section 27 10 00 for additional information/requirements.

B. Equipment to be installed per manufacturer's instructions.

C. Devices requiring PoE power shall be connected to a PoE switch in the MDF/IDF data rack – verify for adequate PoE power capacity.

3.07 CONFIGURATION

A. Program cameras and/or NVR with network IP address using information provided by the District's Technology Services department.

B. All equipment to be fully configured and tested for functionality prior to District acceptance testing.

3.08 CAMERA VIEW

A. Adjust view aim, zoom, and focus camera to show intended view from design documents. Contractor to coordinate with District for final acceptance of camera views.

3.09 FIELD QUALITY CONTROL AND TESTING

A. Upon completion of network programming and initial view setting, notify District of your readiness to perform the formal camera view review with District or its representative. Make all adjustments required from District review.

B. Submit the Record Drawings (as-builts) to District for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system, Contractor to have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District when ready to perform a re-inspection of the installation.

3.10 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Multidirectional Network Camera (4x2MP)	**Axis**	**OFCI**
Panoramic Network Camera (2x5MP)	**Axis**	**OFCI**
Dome Network Camera, Outdoor (5MP)	**Axis**	**OFCI**
Pendant Kit for Multidirectional Camera	**Axis**	**T94N01D**
Wall Mount for Multidirectional Camera	**Axis**	**T91H61**
Corner Bracket for Multidirectional Network Camera	**Axis**	**T91A64**
Conduit Adapter 3/4" for Panoram-ic Network Camera	**Axis**	**5505-541**

SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Furnish and install all materials and equipment including all required equipment, panels, raceways, conductors and connections, and provide all labor required and necessary to complete the work shown on the drawings and/or specified and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete addressable fire alarm installation including all accessories and appurtenances required for testing the systems. It is the intent of the drawings and specifications that all systems be complete, and ready for operation. No extra charge will be paid for furnishing items required by regulations, but not specified herein, or on drawings.

B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the FACP and designated personnel in other buildings at the site via a multiplex communication network.

D. See site drawings for specific requirements for the site.

1.2 RELATED WORK:

A. Refer to the General Conditions, Supplementary General Conditions, and Division 1 General Requirements.

B. See the following specification sections for work related to the work in this section:
   1. 28 05 00 - General Requirements for Electronic Safety and Security
   2. 26 05 33.13 - Raceways and Fittings for Electrical Systems
   3. 26 05 33.16 - Boxes for Electrical Systems
   4. 28 05 13 - Wire and Cable for Electronic Safety and Security

1.3 STANDARDS AND CODES:

A. Devices and equipment for fire alarm system shall be U.L. listed. Underwriters Laboratories (UL) Standards:
   1. UOJZ Control Units
   2. 38 Manual Operation Signal Boxes
   3. 268 Smoke Detectors for Fire Alarm Signaling Systems
   4. 268A Smoke Detectors for Duct Application
   5. 464 Audible Signal Appliances
   6. 521 Heat Detectors for Fire Protective Signaling Systems

7. 864 Control Units and Accessories for Fire Alarm Systems
8. 1635 Digital Alarm Communicator System Units
9. 1971 Signaling Devices for Hearing Impaired

B. Devices and equipment for fire alarm system shall be listed by the California State Fire Marshal for the specific purpose the device or equipment is used.

C. Work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:
1. California Building Code (CBC), Volumes #1 and #2 (Part 2, Title 24, CCR).
2. California Electrical Code (Part 3, Title CCR).
3. California Mechanical Code (CMC) (Part 4, Title 24, CCR).
4. California Plumbing Code (CPC) (Part 5, Title 24, CCR).
5. California Energy Code (Part 6, Title 24, CCR).
6. California Fire Code (CFC) (Part 9, Title 24).
7. California Green Code (Part 11, Title 24, CCR).
8. California Referenced Standards Code (Part 12, title 24, CCR).
9. NFPA 72 National Fire Alarm Code.
10. NFPA 13 Standards for Fire Sprinkler Systems.
11. ADA Standards for Accessible Design: ADA Accessibility Guidelines (ADAAG) 28, Part 36 Appendix A.
12. ADA Standards for Accessible Design: Code of Regulations (Including Amendments)

1.4 SUBMITTALS:

A. In accordance with Section 28 05 00.

B. Submit the following items:
1. Manufacturer's Catalog Data: Manufacturer's original catalog cuts and original description of data of all material and equipment with sufficient information provided so that the exact function of each device is known. Each item supplied shall be clearly identified including both U.L. number and a copy of the State Fire Marshal's listing.
2. Description of conductors to be used with a statement that all wire shall be in conduit.
3. Voltage drop calculations: Verify that voltage drop on signal device circuits does not exceed 10%.
4. Battery Calculations: Verify that battery capacity exceeds supervisory and alarm power requirements, minimum twenty-four (24) hours supervisory plus 15 minutes at full alarm.
5. Floor plan of the point to point connections.
6. Diagram of the power circuitry.
7. Riser diagram.

8. Copy of California State DIR Fire/Life Safety Certificate of installer.
9. Letter on contractor's letterhead certifying that contractor has at least 3 years experience successfully installing fire alarm systems of similar type and design, or that there is a contractual agreement with a subcontractor having at least 3 years experience successfully installing fire alarm systems of similar type and design.

1.5 SUBSTITUTIONS:

A. Fire Alarm System Manufacturer is an Owner Standard no substitutions allowed.

1.6 QUALIFICATIONS OF INSTALLER:

A. NICET level 2 or greater.

B. Prior to installation, submit data for review showing that the contractor has at least 3 years experience successfully installing fire alarm systems of similar type and design, or that there is a contractual agreement with a subcontractor having at least 3 years experience successfully installing fire alarm systems of similar type and design.

C. One contractor shall furnish and install a complete Fire Alarm and Smoke Detection System as described herein and drawn. Installation shall be by a factory authorized installer of the fire alarm system.

1.7 WARRANTIES:

A. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year (365 days) from the date of final acceptance. The contractor shall without additional expense to the owner, replace any defective materials or equipment provided by him under this contract within the warranty period.

B. FACP shall have a five year manufacturer's warranty from the date of final acceptance.

C. Signaling devices shall have a two year manufacturer's warranty from the date of final acceptance.

PART 2 PRODUCTS

2.1 MANUFACTURER:

A. (E) Fire Alarm Control Panel (FACP):
   1. Edwards EST-3, CSFM listed at time of installation

B. Smoke Detector (Photoelectric):
   1. Edwards SIGA-PCD, CSFM 7275-1657:0334

C. Heat Detector (Fixed Temp, 190°):
   1. Edwards SIGA-HFD, CSFM 7270-1657:0333

D. Addressable Relay Module:
   1. Edwards SIGA-CR, CSFM 7300-1657:0121

E. Remote Notification Power Supply:
   1. Edwards 3-PPS, CSFM listed at time of installation

F. Strobe:
   1. Edwards G1VRF, CSFM 7125-1657:0506

2.2 COMPONENTS:

A. Colors: Provide finish colors under this section in accordance with FED-STD-595.

2.3 FIRE ALARM CONTROL PANEL:

A. Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
   1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
   2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
   3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

C. The FACP shall be capable of communicating over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

D. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps.

E. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.

F. The FACP shall be able to provide the following software and hardware features:
   1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm

Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.
10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000-event history file.
11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of

the device.

13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result of all cooperating detectors chamber readings.
22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the

LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LCD. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
24. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.
25. Security Monitor Points: The system shall provide means to monitor any point as a type security.
26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to

the logic zone shall activate.

31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

G. Central Processing Unit
    1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
    2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
    3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
    4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
    5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
    6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

H. Display
   1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
   2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

I. Loop (Signaling Line Circuit) Control Module
   1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159monitor or control modules.
   2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
   3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit.
   4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

J. Digital Voice Command Center
   1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
   2. Function: The Voice Command Center equipment shall perform the following functions:
      a. Operate as a supervised multi-channel emergency voice communication system.
      b. Operate as a two-way emergency telephone system control center.

c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
e. Provide all-call Emergency Paging activities through activation of a single control switch.
f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
h. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

K. Power Supply
1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Main Power Supply shall be power-limited per UL864 requirements.
6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunicated and logged to the system alarm history log.

7. Addressable Charger Power SupplyThe auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power. . NOTIFIER model # ACPS-610
8. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.
9. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "A" or Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
16. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
17. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired

Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.

19. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Steady, March Time, Dual Stage or Temporal.
20. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control
   1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
   2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
   3. A built-in microphone shall be provided to allow paging through speaker circuits.
   4. System paging from emergency telephone circuits shall be supported.
   5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
      a. Lamp Test
      b. Trouble
      c. Off-Line Trouble
      d. Microphone Trouble
      e. Phone Trouble
      f. Busy/Wait
      g. Page Inhibited
      h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators
   1. Speaker Switches/Indicators
      a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
      b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
   2. Emergency Two-Way Telephone Control Switches/Indicators

a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Remote Transmissions
1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

O. Field Programming
1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. All field defined programs shall be stored in non-volatile memory.

P. Specific System Operations
1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations
1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:

a. Device Status.
b. Device Type.
c. Custom Device Label.
d. Software Zone Label.
e. Device Zone Assignments.
f. Analog Detector Sensitivity.
g. All Program Parameters.

4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

R. Universal Digital Alarm Communicator Transmitter (UDACT):
1. The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.
2. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
3. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
4. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.

5. Communication shall include vital system status such as:
    a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
    b. Independent Addressable Device Status
    c. AC (Mains) Power Loss
    d. Low Battery and Earth Fault
    e. System Off Normal
    f. 12 and 24 Hour Test Signal
    g. Abnormal Test Signal (per UL requirements)
    h. EIA-485 Communications Failure
    i. Phone Line Failure
6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
7. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
8. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
9. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

S. Printer
1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.
3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC

mains are lost. The strip printer shall be UL 864 listed.

T. Smoke Control Annunciator
   1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
   2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
   3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
   4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
   5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.4 ADDRESSABLE DEVICES – GENERAL

A. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.

B. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.

C. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.

D. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.

E. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.

F. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

G. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.

H. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.

I. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.

J. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

K. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

L. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.

M. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

N. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

2.5 SMOKE DETECTOR (PHOTOELECTRIC):

A. The intelligent photoelectric smoke detector shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

2.6 HEAT DETECTOR (FIXED TEMP, 135° OR 190°):

A. The intelligent thermal detectors shall be addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius). A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

2.7 ADDRESSABLE RELAY MODULE:

A. Addressable Relay Modules shall be available for HVAC control and other network building functions.

B. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

C. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;

D. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

2.8 REMOTE NOTIFICATION POWER SUPPLY:

A. RNPS shall provide additional supervised, notification appliances circuits to the fire alarm system.

B. Primary Power:

1. Provide 120 VAC service to each RNPS, transformed through a two-winding isolation-type transformer and rectified to 24 VDC for operation of alarm notification circuits. All primary power supplies for the system shall be via separate, lockable, circuit breakers, dedicated to fire alarm equipment. The circuit breakers shall be identified "Fire Alarm System" with a red and white engraved plastic sign permanently affixed to the face of the circuit breaker.

C. Auxiliary Power:

1. Provide 24 VDC auxiliary power for system operation in the event of a primary power source failure. Independent auxiliary power systems shall be located in each RNPS. Transfer from normal to auxiliary power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

D. RNPS shall be provided with sufficient battery capacity to operate all output circuits upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty four (24) hours followed by 5 minutes of alarm operation at the end of this

period. The system shall automatically transfer to the standby batteries upon power failure.

E. Battery Charger:
   1. Provide solid state, automatic, variable type, battery charger, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less.
      a. Batteries 24 V, rechargeable, gelled electrolyte, totally sealed, fully charged with all interconnections ready for service. Maintenance free, long-life.

F. RNPS shall be modular with solid state microprocessor based electronics. RNPS shall provide stand alone power supply for powering notification appliance circuits. RNPS shall have capacity for up to four class "B" notification appliances circuits. RNPS shall contain built in synchronization to synchronize Code 3 Temporal horns and flashes of strobes. RNPS shall provide the ability to silence horns while maintaining strobe functions. RNPS shall interface with the addressable fire alarm system by means of a Notification Appliance Circuit Module connected to the initiation circuits.

G. RNPS shall provide up to 200 milliamps of continuous auxiliary output for control functions.

2.9 STROBE:

A. The strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer strobe capable of operation at 12.0 or 24.0 nominal Vrms. It shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.

B. A universal mounting plate shall be used for mounting ceiling and wall strobe products. The notification appliance circuit wiring shall terminate at the universal mounting plate. Strobes and the Sync Circuit Module accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync Circuit Module, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

C. Strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed.

D. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at

1 Hz over the strobe's entire operating voltage range.

E. All notification appliances shall be backward compatible.

2.10 WEATHERPROOF SPEAKER:

A. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.

B. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.

C. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.

D. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.

E. All notification appliances shall be backward compatible.

F.

2.11 SIGNAL CONTROL ELEMENT (SCE):

A. Signal control element shall be provided to create an additional supervised notification circuit from an addressable loop. All supervision and trouble reporting to the FACP shall be via the addressable loop.

B. Power for the device and any indicating devices shall be provided via the associated RNPS.

2.12 DUAL SYNC MODULES (DSM):

A. DSM's shall be capable of synchronizing both horns and strobes on a single pair of wires. DSM's shall synchronize two class "B" notification circuits. Horns shall be synchronized to sound in a temporal (code 3) pattern. Provide DSM's for all notification circuits supplied directly by the FACP.

2.13 WIRING:

A. See section 28 05 13. Provide wiring in accordance with NFPA 72. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

B. Conductors shall be solid copper. Wiring shall be in accordance with local, state and national codes and as recommended by the manufacturer of the fire alarm system.

Conductors for 120 volt circuits shall be No. 12 AWG minimum; conductors for low-voltage DC circuits shall be No. 14 AWG minimum for annunciation circuits and No. 18 AWG minimum for initiation circuits.

C. Provide color-coded conductors. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Each conductor used for the same specific function shall be distinctively color coded. Use different color codes for each interior alarm circuit. Each circuit color code wire shall remain uniform throughout the circuit.

D. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

E. Pigtail or "T" tap connections to evacuation alarm horns, horn/strobes and strobes are not acceptable.

2.14 CONDUITS:

A. See section 28 05 13. All fire alarm wiring from the FACP to final devices shall be run in conduit unless other wise noted.

B. Identification of Conduit: New conduits containing fire alarm system conductors shall be permanently painted with red paint at the factory. Junction boxes, covers, gutters, and terminal cabinets, containing fire alarm system conductors, shall be painted red or provided with engraved plastic identification signs permanently attached to the equipment.

C. Fire alarm circuits shall not be run in the same conduit with non-fire alarm circuits. AC circuits shall not be run in the same conduit with DC circuits.

D. Provide wiring in rigid metal conduit, except electrical metallic tubing conduit may be provided in dry locations not enclosed in concrete or where not subject to mechanical damage or vandalism.

E. Conceal conduit in finished areas of new construction and wherever practical in existing construction. Conduit runs shall be straight, neatly arranged, properly supported, and parallel or perpendicular to walls and partitions. Identify conductors within each enclosure where a tap, splice, or termination is made.

F. Underground circuit or circuits in wet areas shall be Type UF or USE cable in schedule 40 PVC conduit

PART 3 EXECUTION

3.1 INSTALLATION:

A. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with the NFPA publications and as modified herein.

B. Follow manufacturers' directions in all cases for installation, testing and energizing.

C. Accurately set, level, support and fasten all equipment.

D. Batteries:
   1. All batteries shall have the date of installation hand written on the side in a location clearly visible to service personnel.
   2. Replace any existing batteries over 4 years old or of unknown age with new compatible, rechargeable, gelled electrolyte, totally sealed, fully charged batteries.

E. Smoke and heat detectors:
   1. Locate detectors in accordance with NFPA 72. If the proposed type of detector has an area coverage capability less than required by NFPA 72, revise detector layout and submit for approval with the detail drawings. Mount detectors at the underside of ceiling or roof decks unless otherwise indicated.
   2. No detector shall be located closer than 12 inches to any part of any lighting fixture. Detectors, located in areas subject to moisture or exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be approved for such locations.
   3. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

F. Conduit where exposed shall be installed parallel with walls or structural elements; vertical runs to be plumb; horizontal runs level or parallel with structure; conduit grouped neatly together with straight runs, all bends parallels and uniformly spaced.

G. Earthquake Resistant installation/fastening of all electrical equipment shall conform to seismic code requirements. Where anchorage details are shown or not shown on the Drawings, the field installation shall be approved by a Structural Engineer.

H. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

I. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 PRELIMINARY TESTS:

A. Before final acceptance of the work, pre-test system to demonstrate compliance with the contract requirements. System shall be subjected to complete functional and operational tests, including tests in place for each detector. Correct deficiencies pertaining to these requirements prior to formal functional and operational tests of the system. When tests have been completed and corrections made, submit test results and a signed and dated request for formal inspection and final test witnessing.

B. Conduct the following tests during installation of wiring and system components. Preliminary test shall be performed in the presence of the Local Fire Authority and Project Inspector of Record to determine conformance with the specified requirements:

1. Visually inspect all strobes and horn/strobes to ensure that strobe settings are as shown on the drawings.
2. Ground Resistance:
   a. Measure the resistance of each connection to ground. Ground resistance shall not exceed 10 ohms.
3. Dielectric Strength and Insulation Resistance:
   a. Test the dielectric strength and the insulating resistance of the system interconnecting wiring by means of an instrument capable of generating 500 volts DC and equipped to indicate leakage current in megohms. For the purpose of this test, connect the instrument between each conductor on the line and between each conductor and ground at the control panel end of the line, with the other extremity open circuited and all series-connected devices in place. The system shall withstand the test without breakdown and shall indicate a resistance of not less than 50 megohms, the measurement being taken after an electrification of 1.0 minute with a DC potential of 500 volts.
4. Standby Battery Test:
   a. Prior to formal inspection and tests, place the fire alarm system on standby battery power for twenty-four (24) hours; immediately thereafter, sound the building evacuation alarm signaling devices for 5 minutes. When the test is complete, allow fire alarm system battery charger to recharge the standby batteries for 24 hours and place the fire alarm system on standby battery power for an additional twenty-four (24) hours; immediately thereafter, sound the building evacuation alarm signaling devices for 5 minutes. Certify that the Fire Alarm System has satisfactorily sounded building evacuation alarms for 5 minutes after the second twenty-four (24) hours on battery power.

3.3 FIELD INSPECTION AND FINAL TEST:

A. Perform the formal inspection and final test in the presence of the in the presence of the manufacturer's representative, the owners representative, Local Fire Authority and Project Inspector of Record (IOR). NFPA 72 "Inspection and Testing Form" shall be filled out completely and signed by those performing and witnessing the final test:
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
   3. Verify activation of all waterflow switches.
   4. Open initiating device circuits and verify that the trouble signal actuates.
   5. Open and short signaling line circuits and verify that the trouble signal actuates.
   6. Open and short notification appliance circuits and verify that trouble signal actuates.
   7. Ground all circuits and verify response of trouble signals.
   8. Check presence and audibility of tone at all alarm notification devices.

9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
11. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.
12. Test 100% of all automatic fire detection devices:
    a. Where application of heat would destroy any heat detector, it may be manually activated.
13. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per zone to check for the presence of correct supervisory circuitry.

B. Test Equipment: It shall be the responsibility of the installing Contractor to furnish tools, instruments, and materials required for the thorough test of the system. This includes, but is not limited to, the following:
1. VOM meter
2. Manufacturers recommended smoke detector testing device and sensitivity test equipment.
3. Heat source for testing rate of rise heat detectors.
4. Keys to all control panels
5. Ladders

3.4 TRAINING:

A. Provide minimum four hours on site training by FACP manufacturer factory trained and authorized personnel.

B. Training sessions shall provide:
1. Instruction on operating the fire alarm system.
2. "Hands-on" demonstrations of the operations of all system components.
3. Instruct process for changing program and functions.

C. Permanently attach Sequence of Operation for fire alarm panel on wall next to FACP. Coordinate exact location with Owner.

3.5 PROJECT CLOSEOUT:

A. As Built Drawings:
1. Provide in accordance with section 28 05 00.
2. Provide a complete set of reproducible "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring

of the equipment upon completion of system:

a. Drawings shall include actual voltage drop calculations as installed for all new or modified notifications circuits.
b. Drawings shall include actual battery calculations as installed for any new FACP's or RNPS's or any FACP's or RNPS's whose loads have been modified.

B. Operating and Instruction Manuals:
1. Operating and instruction manuals shall be submitted prior to testing of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to the owner upon completion.
2. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a trouble shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to the owner upon completion of the system.
3. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
a. Instruction on replacing any components of the system, including internal parts.
b. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions.
c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
d. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

END OF SECTION

SECTION 31 05 13 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the soils report (which shall be a part of the contract documents). Contractor shall be responsible for securing a copy of the soils report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.

B. Related Sections:
1. Section 31 22 13 - Rough Grading.
2. Section 31 23 00 - Excavation and Fill.
3. Section 31 23 23.13 - Backfill.
4. Section 31 23 16.13 - Trenching.
5. Section 32 12 16 - Asphalt Pavement.
6. Section 32 11 23 - Aggregate Base Course.
7. Section 32 90 00 – General Planting.

1.2 REFERENCES

A. The project Soils Report and any supplements to the Soils Report.

PART 2 - PRODUCTS

2.1 TOPSOIL MATERIALS

A. Topsoil materials shall meet to the requirements of Section 32 90 00 General Planting.

B. Class II Permeable Material shall meet the requirement of Caltrans Standard Specifications 68-1.025.

PART 3 - EXECUTION

3.1 SOIL REMOVAL

A. Conduct earthwork operations in accordance with the provisions of the Soils Report and any supplements to the Soils Report, and as directed by the Soils Engineer.

END OF SECTION 31 05 13

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes removal of surface debris; removal of paving, curbs, sidewalks; removal of trees, shrubs, and other plant life; removal of underground storage tanks; and removal of abandoned utilities.

B. Related Sections:
1. Section 31 05 13 – Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Removed materials are to be removed from the site and disposed of in a lawful manner.

3.2 PROTECTION

A. Locate, identify, and protect utilities from damage that are to remain.

B. Protect trees, plant growth, and features designated to remain.

C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.3 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees and shrubs indicated and in a manner specified on the drawings or in these specifications. Remove tree and shrub root bulbs in their entirety and to a maximum root diameter of one inch.

3.4 REMOVAL

A. Remove debris, rock, and extracted plant life from site to the limits indicated on the drawings.

B. Remove paving, curbs, and concrete from the site to the limits indicated on the drawings.

C. Neatly saw cut edges at limits indicated for all pavement, curbs, and walkways to be removed.

D. Excavate and remove any underground storage tanks and associated plumbing piping, as indicated on the drawings.

3.5 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Stockpile on site and protect from erosion.

C. Remove excess topsoil not intended for reuse, from site.

END OF SECTION 31 10 00

SECTION 31 22 13 – ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes removal of topsoil and cutting, grading, filling, rough contouring, and compacting as indicated on the drawings.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 10 00 - Site Clearing.
3. Section 31 23 00 - Excavation and Fill.
4. Section 31 23 16.13 - Trenching.
5. Section 31 23 23.13 - Backfill.
6. Section 32 90 00 – General Planting.

1.2 REFERENCES

A. The provisions of the project Soils Report and any supplements to the Soils Report shall be adhered to for rough grading of the site.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: as specified in Section 32 90 00 Planting.

B. Other Fill Materials: shall adhere to the provisions of the project Soils Report and any supplements to the Soils Report.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 06 00 - Regulatory Requirements.

B. Verify site conditions.

C. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage utilities that are to remain.

D. Notify affected utility companies to remove or relocate public utilities indicated on the plans to be removed or relocated by the utility company.

E. Protect above and below grade utilities that are to remain.

F. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

G. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 SOIL EXCAVATION

A. Excavate soil from areas to be further excavated, relandscaped, or regraded. as shown on the drawings.

B. When excavating through roots, for trees to remain, perform work by hand and cut roots with sharp axe.

C. Remove excess soil from site.

D. Benching Slopes: Horizontally bench existing slopes steeper than 1:4 (vertical:horizontal) to key placed fill material to slope to provide firm bearing as required by the Soils Report and any supplements to the Soils Report. Minimum horizontal bench shall be 2 feet wide.

E. Stability: Replace damaged or displaced subsoil to same requirements as for specified

fill.

3.4 FILLING

A. Install Work in accordance with the project Soils Report and any supplements to the Soils Report.

B. Fill areas to contours and elevations with suitable materials.

C. Place fill material on continuous layers and compact in accordance with the project Soils Report and any supplements to the Soils Report.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from buildings at a minimum slope of two (2%) percent unless noted otherwise.

F. Make grade changes gradual. Blend slope into level areas.

G. Remove surplus fill materials from site.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Control Requirements.

B. Top Surface of Subgrade: Plus or minus 0.05 feet from required elevation on paved or walkway areas and zero (0) feet to minus 0.10 foot in building pad areas.

3.6 FIELD QUALITY CONTROL

A. Testing and inspection shall be provided by the project soils engineer.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at the Contractor's sole expense.

END OF SECTION 31 22 13

SECTION 31 23 00 – EXCAVATION AND FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes excavating for building foundations, roads, parking areas, site grading, slabs-on-grade, landscaping areas, and for site structures.

B. Related Sections:
1. Section 31 05 13 – Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 16.13 - Trenching.
4. Section 31 23 23.13 - Backfill.

1.2 REFERENCES

A. The project Soils Report and any supplements to the Soils Report.

B. Local utility standards when working within 24 inches of the respective utility lines.

PART 2 - PRODUCTS

A. Bio-Retention Soils

1. Permeable Class II Aggregate Base or crushed drain rock.

2. Planting soil is 60% sand, 40% compost mix allowing 5”/hour percolation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

3.2 EXCAVATING

A. Underpin adjacent structures which may be damaged by excavating work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures.

C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 23.13 and 31 23 16.13.

D. Slope banks with machine to angle of repose or less until shored.

E. Do not interfere with 45 degree bearing splay of foundations.

F. Grade top perimeter of excavating to prevent surface water from draining into excavation.

G. Hand trim excavation. Remove loose matter.

H. Remove lumped subsoil, boulders, and rock in accordance with the provisions of the Soils Report and any supplements to the Soils Report.

I. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume Work.

J. Correct areas over excavated with backfill and compact replacement as specified for authorized excavation.

K. Remove excess excavated material from site.

3.3 FIELD QUALITY CONTROL

A. The project Soils Engineer shall provide testing and inspection services.

3.4 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 31 23 00

SECTION 31 23 16.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes excavating trenches for utilities from outside building to final connection point or public right-of-way or utility; compacted fill from top of utility bedding to subgrade elevations; and backfilling and compaction.

B. Related Sections:
1. Section 31 05 13 – Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 00 - Excavation and Fill.
4. Section 31 23 23.13 - Backfill.
5. Section 33 40 00 – Storm Drainage Utilities.

1.2 REFERENCES

A. The project Soils Report and any supplements to the Soils Report.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.5 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

B. Verify elevations of existing facilities prior to placing new Work.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Fill and Structural Fill shall be: As specified in the project Soils Report and any supplements to the Soils Report.

2.2 ACCESSORIES

A. Filter Fabric: Non-biodegradable, woven as manufactured by TC Mirafi, Tenax Corp., Tensar Earth Technologies, Inc. or equal.

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Grades
1. Pipes shall be laid true to the lines and grades indicated.
2. The grade alignment of the pipe shall be maintained by the use of a string line parallel with the grade line and vertically above the centerline of the pipe. This line shall be established on level batter boards at intervals of not more than 25 feet. Batter boards shall span the trench and be rigidly anchored to substantial posts driven into the ground on each side of the trench. Three adjacent batter boards must be set before laying pipe to provide a check on the grades and line. Elevation and position of the string line shall be determined from the elevation and position of offset points or stakes located along the pipe route. Pipe shall not be laid using side lines for line or grade.
3. As an alternative means of establishing alignment and grade, a "Laser-Beam" instrument may be utilized with a competent operator.

B. Location of Pipe Lines:
1. The location and approximate depths of the proposed pipe lines are shown on the Drawings.
2. An underground locate service shall be enlisted to discover the location of existing utilities regardless if they are shown on the drawings.
3. The Architect/Engineer reserves the right to make changes in lines, grades, and depths of pipe lines and manholes when such changes are necessary.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from

excavating equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities which are to remain.

E. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.

3.3 EXCAVATING

A. Excavate subsoil required for utilities.

B. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock as directed by the Soils Engineer or other inspector.

F. Correct over excavated areas with backfill and compact replacement as specified for authorized excavation.

G. Stockpile excavated material on site. Remove excess material not being used from site.

3.4 TRENCHING

A. Excavations:
1. Excavation shall be dug so that the pipe can be laid and jointed properly. The trench shall be made so that the pipe can be laid to the alignment and depth as shown on the Drawings, and it shall be excavated only so far in advance of pipe laying as permitted by the Architect/Engineer. The excavation shall not be more than two feet wider at the bottom than the outside diameter of the pipe or structure. If there is no interference with construction, or adjacent property, and if soil permits, the Contractor at his own expense shall be permitted to slope the side walls of the excavation starting at a point two (2) feet above the top of pipe.
2. The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe on bedding material at every point between joints, except where pipe slings or other lifting tackle are withdrawn.
3. Excavation Below Grade:
1) Where excavation indicates that the subsurface materials at the bottom

of the trench are in a loose or soft state, the Contractor shall be advised to excavate to a depth where suitable material is encountered, as directed by the Architect/Engineer.

2) Where the bottom of the trench has been excavated by mistake to a greater depth than required, the Contractor shall refill this area using approved material. No additional compensation shall be given to the Contractor. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.

4. Excavation within 24 inches of existing utilities shall be governed by specifications of the Owner of the respective utility. The Contractor shall obtain these specifications and follow the same at no extra cost.
5. Excavation and shoring shall adhere to the requirements and safety standards set by OSHA.

B. Trenching in Advance of Pipe Laying: The trench for the pipe lines shall not be opened for a distance of more than 200 feet at any one time, unless authorized by the Architect/Engineer. At no time will the Contractor be permitted to leave more than 50 feet of trench open at the end of a working day. Adequate protection of open trench shall be provided by the Contractor and the Contractor shall be responsible therefore.

3.5 SHEETING AND BRACING

A. General:
1. Sheeting and bracing of all excavations shall conform to the latest statutes of the State of California governing safety of workers in the construction industry. When necessary, in the opinion of the Contractor, adequate sheeting and bracing shall be installed to prevent ground movement that may cause damage or settlement to adjacent structures, pipelines and utilities. Any damage due to settlement because of failure to use sheeting or because of inadequate bracing, or through negligence or fault of the Contractor in any other manner, shall be repaired at the Contractor's expense.
2. Sides of trenches in unsuitable, loose or soft material, five feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect employees working within them.

B. Sheeting Requirements:
1. Where excavations are made with vertical sides which require supporting, the sheeting and bracing shall be of sufficient strength to sustain the sides of the excavations and to prevent movement which could in any way injure the Work, or adjacent structures, or diminish the working space sufficiently to delay the Work. Special precautions shall be taken where there is additional pressure due to the presence of other structures.
2. It shall be the Contractor's responsibility to select sheeting and bracing of

sufficient dimensions and strength and type to adequately support the sides of trenches and excavations.

3. Sheeting and bracing shall be removed before the completion of the Work.

3.6 BACKFILLING

A. Backfill trenches to contours and elevations shown on the drawings.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

C. Fill materials shall be as specified in the Soils Report and any supplements to the Soils Report.

D. Employ a placement method that does not disturb or damage utilities in trench. Jetting of backfill materials to achieve compaction shall not be permitted.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Remove surplus fill materials from site.

3.7 TOLERANCES

A. Section 01 40 00 - Quality Requirements.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 0.05 feet from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1/10 feet from required elevations.

3.8 FIELD QUALITY CONTROL

A. Compaction testing will be performed by the project Soils Engineer.

B. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 77 00 - Closeout Procedures.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 31 23 16 13

SECTION 31 23 23.13 - BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building perimeter and site structure, filling and backfilling to subgrade elevations; fill under slabs-on-grade, paving; fill for over-excavation; consolidation and compaction as specified in the Soils Report and any supplements to the Soils Report.

B. Related Sections:
   1. Section 31 05 13 – Soils for Earthwork.
   2. Section 31 23 00 - Excavation and Fill.
   3. Section 31 23 16.13 - Trenching.

1.1 REFERENCES

A. The project Soils Report and any supplements to the Soils Report.

PART 2 - PRODUCTS

1.2 FILL MATERIALS

A. Fill and Structural Fill as specified in the Soils Report and any supplements to the Soils Report.

1.3 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven as manufactured by TC Mirafi, Tensar Earth Technologies, Inc. or equal.

PART 2 - EXECUTION

1.4 EXAMINATION

A. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

B. Verify structural ability of unsupported walls to support loads imposed by the fill.

1.5 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent fill material.

C. Roll subgrade surface to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

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1.6 BACKFILLING

A. Backfill areas to contours and elevations shown on drawings.

B. Employ a placement method that does not disturb or damage other work.

C. Maintain optimum moisture content of backfill materials to attain required compaction density.

D. Backfill against supported walls and structures. Do not backfill against unsupported walls or structures.

E. Backfill simultaneously on each side of unsupported walls and structures until supports are in place.

F. Slope grade away from building at a minimum slope of two (2%) percent, unless noted otherwise.

G. Make gradual grade changes. Blend slope into level areas.

H. Remove surplus backfill materials from site.

1.7 TOLERANCES

A. Section 01 40 00 - Quality Requirements.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 0.05 feet from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1/10 feet from required elevations.

1.8 FIELD QUALITY CONTROL

A. The project Soils Engineer shall provide testing and inspection services.

1.9 PROTECTION OF FINISHED WORK

A. Section 01 77 00 - Closeout Procedures.

B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION 31 23 23.13

SECTION 32 11 23 - AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aggregate base course.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 23.13 - Backfill.
4. Section 31 23 16.13 - Trenching.
5. Section 32 12 16 - Asphalt Pavement.
6. Section 32 13 13 - Concrete Paving.
7. Section 33 49 13 - Storm Drainage Manholes, Frames, and Covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Class II Aggregate Base per Caltrans Standard Specifications, or Local Municipality.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Place aggregate in maximum 6-inch layers and compact to specified density.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation From Design Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Compaction testing will be performed in accordance with ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to owner.

END OF SECTION 32 11 23

SECTION 32 12 16 - ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes asphaltic concrete paving, wearing, binder and base course; surface sealer; and aggregate base course.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 22 13 - Rough Grading: Preparation of site for paving and base.
3. Section 31 23 23.13 - Backfill: Compacted subbase for paving.
4. Section 32 11 23 - Aggregate Base Course.

1.2 REFERENCES

A. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

B. ASTM D3381 - Viscosity Graded Asphalt Cement for Use in Pavement Construction.

C. TAI - (The Asphalt Institute) - MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

D. TAI - (The Asphalt Institute) - MS-3 Asphalt Plant Manual.

E. TAI - (The Asphalt Institute) - MS-8 Asphalt Paving Manual.

F. TAI - (The Asphalt Institute) - MS-19 Basic Asphalt Emulsion Manual.

G. Caltrans Standard Specifications, 2010 Edition, Section 39.

1.3 SUBMITTALS

A. Product Data: Submit product information and mix design.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Caltrans Standard Specifications.

B. Mixing Plant: Conform to Caltrans Standard Specifications.

C. Obtain materials from same source throughout.

D. Maintain one copy of each document on site.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Pavement: In accordance with Caltrans Standard Specifications.

2.2 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services: Provide mix design for asphalt.

B. Submit proposed mix design for review prior to beginning of Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

B. Verify compacted granular base is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Section 32 11 23 - Aggregate Base Course forms the base construction for Work of this section.

3.3 PREPARATION - PRIMER

A. Apply primer in accordance with Caltrans Standard Specifications.

3.4 PREPARATION - TACK COAT

A. Apply tack coat in accordance with Caltrans Standard Specifications.

B. Apply tack coat to contact surfaces of curbs and gutters.

C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.5 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with Caltrans Standard Specifications.

B. Asphalt paving for pedestrian/non-vehicular paving shall be 3/8" mix.
Asphalt paving for vehicular paving shall be ½" mix.

3.6 PLACING FOG SEAL

3.7 CURBS

A. Install extruded asphalt curbs of profile as indicated on drawings.

3.8 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation from True Elevation: Within 1/2 inch.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requiremetns: Testing and inspection services
Section 01 77 00 – Closeout Procedures: Testing, adjusting, and balancing.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 77 00 – Closeout Procedures: Protecting finished work.

B. Immediately after placement, protect pavement from mechanical injury for 24 hours or until surface temperature is less than 140 degrees F.

3.11 SCHEDULES

A. Pavement sections for various locations and uses are to be as shown on the drawings.

END OF SECTION 32 12 16

SECTION 32 12 36 - SLURRY SEAL EXISTING ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the soils report (which shall be part of the Contract Documents). Contractor shall be responsible for securing a copy of the soils report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.

1.2 DESCRIPTION OF WORK:

A. Extent of asphalt slurry work is shown on drawings.

1.3 SUBMITTALS:

A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4 SITE CONDITIONS:

A. Weather Limitations: Do not apply when base is wet or contains an excess of moisture.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

B. OverKote Seal: Asphalt pavement coating as manufactured by Reed & Graham, Inc. or approved equal.

C. OverKote Crackfiller as manufactured by Reed & Graham, Inc. or approved equal.

D. OverKote Oil Spot Sealer as manufactured by Reed & Graham, Inc. or approved equal.

E. 30 Mesh Sand

PART 3 - EXECUTION

3.1 CRACK FILLING AND SURFACE PREPARATION:

A. Cracks 1/8" or larger shall be cleaned and filled to a level surface with OverKote Crackfiller. A "V" shaped squeegee is recommended for this application. Mix and apply per manufacturer recommendations.

B. All areas to be sealed shall be thoroughly cleaned. Dirt, loose pieces and other obstructions in joints or cracks shall be removed with an air jet and/or pressurized water.

C. Excessive oil spots shall be removed with a scraper, stiff brush and detergent. OverKote Oil Spot Sealer shall be applied to prepared oil spots.

D. In exceptionally hot weather, dampen the surface with water. Remove any excess water to leave the surface only slightly damp.

3.2 SLURRY SEAL APPLICATION –OverKote Asphalt Paving Coating

A. Prior to bidding, consult manufacturer for recommendations on mix and number of applications required to result in a smooth and uniform surface for this application. A minimum of two applications shall be required, more if necessary.

B. Depending on the surface, one or more applications may be required at the rate of 25 to 35 gallons per 1,000 square feet of surface area. The surface shall be smooth and uniform upon completion. For excessively rough areas, add 2 to 3 pounds of 30 mesh sand per gallon of OverKote Sealer. Additional sand may be added per custom specification request.

C. Apply OverKote slurry seal to surface course in accordance with manufacturer recommendations. Spread immediately by machine, squeegee, stiff plastic bristle or

soft hair push broom. Spread poured parallel lines by pulling material at an angle toward operator. Tools shall be wet before using. Repeat as necessary to spread sealer uniformly, eliminating all laps and ridges. Apply 2nd coat as soon as first coat is dry.

D. A second application shall be made after first coat has dried to the touch. When sand is added to the first seal coat, two additional coats without extra sand shall be applied.

E. Protect from trespass until sealed area is dry.

F. Allow slurry seal to dry before permitting traffic or striping.

3.3 FIELD QUALITY CONTROL:

A. Contractor shall obtain approval of surface preparation from Owner's Representative prior to application of slurry seal.

B. Contractor shall obtain approval of slurry seal application finish surfaces from Owner's Representative prior to completion and prior to striping.

END OF SECTION 32 12 36

SECTION 32 13 13 – CONCRETE PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the soils report (which shall be part of the Contract Documents). Contractor shall be responsible for securing a copy of the soils report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.

C. Specification Division 31, Earthwork, Soils and Earthwork, Rough Grading, and Excavation and Fill.

D. Specification 32 11 23 Aggregate Base Course.

1.2 DESCRIPTION OF WORK:

A. The extent of concrete work is shown on the landscape architectural drawings and details and shall include, but is not limited to, pedestrian concrete walkways, steps, ramps, curbs, mowbands, footings and walls.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
2. ACI 318 Building Code Requirements for Structural Concrete.
3. ASTM C150, for Type I, Type II or Type III Portland cement concrete.
4. Chapter 19A, 2016 C.B.C.

B. Certification: Weighmaster Certificate

C. Duties of the Inspector: The inspector shall notify the Architect, Structural Engineer and the Division of State Architect at least 48 hours in advance of the first pour of concrete and sufficiently in advance of subsequent pours. Comply with Section 4-333.1 and Chapter 7, Part I, Title 24, California Code of Regulations (CCR).

D. Installer Qualifications:

1. Experience: The concrete installing firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
2. Licensure: The concrete installation firm shall hold a current, active C8 "Concrete Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
3. Supervision: The concrete installing firm shall have a qualified and experienced concrete technician on site during concrete installation.

E. "Colored" Concrete Installer Qualifications: Installer of "colored" concrete shall be qualified by Scofield. Contact local Scofield Representative or the Division Office (323) 720-3055 for a list of locally qualified installers.

1.4 SUBMITTALS:

A. Shop Drawings Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.

B. Design Mixes Submittal: Submit written reports of design mixes to the Architect of each proposed mix for each class of concrete within thirty-five (35) days after the issuance of the "Notice to Proceed", but no later than ten (10) days prior to the first scheduled concrete pour. Do not begin concrete production until all design mixes have been reviewed by the Architect and independent testing facility.

Separate submittal data shall be submitted for each mixture for the following:

1) Concrete Paving – Pedestrian, steps, curbs, walls and footings.
2) Concrete Paving – Vehicular.

C. Job-site Samples: Contractor shall pour concrete samples as indicated below for each concrete color and finish specified on Drawings for written approval from Owner's Representative prior to installation as follows:

1. Two (2) foot by two (2) foot concrete flatwork.
2. Two linear feet by width and height detailed for each concrete wall specified to include decorative tile if specified.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments.

D. Expansion Joint for flatwork that does not have a stamp pattern: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.

E. Expansion Joint for poured-in-place walls: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.

2.2 REINFORCING MATERIALS:

A. Reinforcing Bars (Rebar): ASTM A 615, Grade 60, deformed, except #3 and smaller may be Grade 40. Test in accordance with Section 1903A and 1910A.2, 2016 C.B.C.

B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.

2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type V, conforming to ACI 318-14 and test in accordance with Section 1903A, 2016 C.B.C.

B. Fly Ash or other pozzolan can be used as a partial substitute for ASTM 150 Portland cement as follows:

1. Fly Ash conforming to ASTM C618, Class F, the maximum Loss on Ignition (LOI) shall be less than 3%. Class C is not permitted.

2. Slag, Ground Granulated Blast Furnace Slag Cement (GGBFS) shall conform to ASTM C989 or AASHTO M 302 Grade 100 or 120.

3. Silica Fume: ASTM C1240, Standard Specification for Silica Fume used in cementitious mixtures.

4. High-Reactivity Metakaolin (HRM): ASTM C618, aluminosilicate pozzolan.

C. Water: Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or reinforcement and shall be tested and verified through ASTM C1602.

D. Admixtures: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ANSI/ASTM C 494, Type A, and contain not more than 1% chloride ions.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D

E. Crushed Aggregate Base Rock: Shall be coarse aggregate for regular weight concrete. Aggregate shall be hard, durable, uncoated, graded, cleaned and

screened crushed rock or gravel conforming to current requirements of ASTM C33. Crusher-run stone or bank-run gravel will not be permitted.

F. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C-309, Type I, Class A unless other type acceptable to Architect. Comply with Volatile Organic Compounds (VOC) content limits, as required by Air Pollution Control Regulations on Architectural Coatings (less than 350 g/l).

G. Curing Methods:

1. Moist Curing: continuous misting, sprinkling or ponding.
2. Moisture-retaining cover curing: After wetting the concrete surface, cover with wet-curing blanket. Lay blanket in accordance with manufacturer's instructions, over-lapping edges and extending edges twelve (12) inches beyond area of concrete to be cured. Remove air pockets. Repair any holes or tears that occur using sheeting material and waterproof tape.
3. Compound curing: Apply specified curing compound as soon as final finishing operations are complete. Use as recommended by the manufacturer's written instructions.

H. Color Materials:

1. Liquid lamp black shall be default color for concrete not specified on drawings as "Natural" or "Colored". Add one pint of liquid lamp black per cubic yard of exterior concrete.
2. Concrete specified as "Natural" shall have no color added.
3. Concrete specified as "Colored" shall be LM Scofield Systems Chromix Admixtures for Color-Conditioned Concrete and/or Scofield Integral Color SG Standard Grade, to include Standard Colors, Custom Colors and Special Order Colors for all concrete specified on drawing as "colored". Colored concrete shall be sealed per manufacturer with LM Scofield Cureseal-W with matte gloss finish, LM Scofield Cureseal-100 with glossy, wet-look, LM Scofield Lithochrome Colorwax concrete curing compound or equal as selected by Architect or Owner's Representative. Contractor shall pour samples on site as necessary for architect and/or owner's representative to select final color(s) for project.

2.4 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type and strength of concrete. Use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Comply with Section ACI 318-14. The compressive strength of concrete shall be proportioned by one of the following methods: Design Mix (Method B) or Pre-Test Mix (Method C).

C. Submit written reports to Architect of each proposed mix for each class of concrete at least 10 days prior to the first scheduled concrete pour. Do not begin concrete production until mixes have been reviewed by Architect.

D. Design mixes to provide normal weight concrete with the following properties:

1. Concrete Paving – Pedestrian, steps, curbs, walls and footings:
   a. 3,000 psi 28-day compressive strength
   b. 0.60, maximum, water to cement (W/C) ratio
   c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
   d. Aggregate to be 1" maximum.
   e. 28-day shrinkage, SEAONC Method: 0.050 maximum.

2. Concrete Paving – Vehicular:
   a. 4,000 psi 28-day compressive strength
   b. 0.50, maximum, water to cement (W/C) ratio
   c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
   d. Aggregate to be 1" maximum.
   e. 28-day shrinkage, SEAONC Method: 0.050 maximum.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

F. Admixtures: Use only as indicated by approved design mix.

G. Color Additive for concrete not specified as "colored": add one pint of liquid lamp black per cubic yard of all exterior concrete which will be visible when cured.

H. Color for concrete specified as "colored": Color mixture as determined by manufacturer in accordance with color selected and sealed per manufacturer recommendations.

I. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

All concrete: Shall be four (4) inches, plus or minus one (1) inch.

2.5 CONCRETE MIXES:

Ready-Mix Concrete: Comply with ASTM C94. Measure, batch and mix concrete materials and concrete according to ASTM C-94. Furnish batch certificates, indicating project identification, name and number, date, mixture type, mixing time, quantity and amount of water added for each batch discharged and used in the Work to the Architect.

2.6 SACK FINISH MORTAR

A. Mortar shall be composed of Portland cement, sand, and water proportioned and mixed as specified in this Section 51-1.135.

B. Mortar shall be furnished and placed in recesses and holes, on surfaces, under structural members, and at other locations specified in these specifications, the special provisions or shown on the plans.

C. The proportion of cement to sand, measured by volume, shall be one to two (1:2) unless otherwise specified.

D. Materials shall conform to the provisions in Section 90, "Portland Cement Concrete."

E. The maximum size of sand shall not be larger than 0.5 of the size of the recess, hole or space where the mortar is to be placed.

F. The mortar shall contain only enough water to permit placing and packing.

G. Concrete areas to be in contact with the mortar shall be cleaned of all loose or foreign material that would in any way prevent bond between the mortar and the concrete surfaces and shall be flushed with water and allowed to dry to a surface dry condition immediately prior to placing the mortar.

H. The mortar shall completely fill and shall be tightly packed into recesses and holes, on surfaces, under structural members, and at other locations specified. After placing, all surfaces of mortar shall be cured by the water method as provided in Section 90-7, "Curing Concrete," for a period of not less than 3 days.

I. Keyways, spaces between structural members, holes, spaces under structural members and other locations where mortar could escape shall be mortar-tight before placing mortar.

J. No load shall be allowed on mortar that has been in place less than 72 hours, unless otherwise permitted by the Engineer.

K. All improperly cured or otherwise defective mortar shall be removed and replaced by the Contractor at the Contractor's expense.

2.7 WATERPROOF MEMBRANE:

Rolled, self-adhering waterproof membrane, composed of nominally 56 millimeter thick layer of polymeric waterproofing membrane on a heavy duty, four-millimeter thick, cross-laminated polyethylene carrier film laminated together, MEL-ROL, product of W. R. Meadows/Sea Tight, or equal conforming to A.R.E.M.A. Specifications Chapter 29, Waterproofing.

PART 3 - EXECUTION

3.1 FORMS:

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Form removal shall comply with ACI 318 Section 26.11.2.

C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings,

recesses and chases from trades providing such items. Accurately place and securely support items build into forms. Comply with ACI 318 Section 26.11.2.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.2 PLACING REINFORCEMENT:

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Where concrete is installed at door thresholds and/or transitions to building interior spaces, 24" length, #3 smooth rebar dowels shall be installed12" into the new concrete paving and 12" into the adjacent building structure, spaced at 18" on center with a minimum of two in each location. Epoxy to secure end of dowel set into building and lubricate end cast into new concrete paving.

F. Where concrete is installed at door thresholds of modular buildings with steel framing, #5 rebar shall be welded securely to building floor plate, extending 12" into new concrete paving, spaced 18" on center with a minimum of two at each door threshold. Lubricate end cast into new concrete paving.

G. Where concrete is installed adjacent to concrete walkways that are part of the building structural pad, 24" length, #3 smooth rebar dowels shall be installed12" into the new concrete paving and 12" into the adjacent building structure pad, spaced at 18" on center spacing. Epoxy to secure end of dowel set into building structural pad and lubricate end cast into new concrete paving.

3.3 EXPANSION AND CONTROL JOINTS:

A. Locate and install joints so as not to impair strength and appearance of the structure, and as acceptable to Architect.

B. Continue reinforcement across expansion and control joints or install smooth rebar dowels.

C. Control/score joints (for walkways, steps, ramps and curbs): Unless shown otherwise on plan, install ½" radius score joints evenly spaced at a maximum of eight feet in two perpendicular directions, continuous and one third the depth of the slab.

D. Control/score joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install ½" radius score joints evenly spaced at a maximum of eight feet in on center. Align vertical wall score joints with horizontal paving joints whenever possible. Install ½" radius or chamfered edge at each side of joint as called for in drawings, continuous and 1 ½" in depth.

E. Expansion Joints (for walkways, steps, ramps and curbs): Unless shown otherwise on plan, install expansions joints where walkways meet existing or proposed structures and evenly spaced at a maximum of 24 feet in two perpendicular directions. Install ½" asphalt saturated felt expansion joint material 1/4" below the finish surface and continuously throughout the full depth of slab.

F. Expansion Joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install expansions joints where walls meet existing or proposed structures and evenly spaced at a maximum of 24 feet in two perpendicular directions. Align vertical wall expansion joints with horizontal paving joints whenever possible. Install ½" asphalt saturated felt expansion joint material ½" below the finish surface where ½" radius concrete edges are indicated and flush with base of chamfer were chamfer edges are indicated and continuously throughout the concrete section. Install ½" radius or chamfered edge at each side of joint as called for in drawings.

3.4 INSTALLATION OF EMBEDDED ITEMS:

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.5 PREPARATION OF FORM SURFACES:

A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

3.6 CONCRETE PLACEMENT:

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in, in accordance with ACI 318-08. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood dorms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials with placement of forms and reinforcing steel.

C. General: Comply with ACI 304, and as herein specified.

D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" in to preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction (expansion) joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in proper position during concrete placement operations.

L. Cold Weather Placing: Do not place concrete when air temperature is below 40 degrees F., or expected to fall below within 24 hours. Comply with ACI 306.

M. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.

N. Concrete flatwork over-pour: Over-pour is excess concrete spilling beyond the limits of the concrete forms. Contractor shall remove over-pour to allow for installation of tree root barriers, irrigation and similar landscape improvements.

3.7 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture impaired by form facing material used, with tie holes and defective areas repaired and patched and fine and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, painting or other similar system. For "as-cast" concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams, repair and patch defective areas with fins or other projections completely removed and smoothed

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

3.8 CONCRETE EXTERIOR FLATWORK FINISHES:

A. Float Finish: Apply float finish to concrete slab surfaces to receive trowel finish and other finishes as hereinafter specified.

B. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Round top edges of all exposed slabs, nosing, etc. with 3/8" radius edging tool, unless chamfered or otherwise noted.

D. Non-Slip Broom Finish (NSBrm-Fn): Unless specified otherwise, apply non-slip broom finish to exterior concrete walks, platforms, steps and ramps, and elsewhere as indicated. Slopes less than 6% shall have a medium broom finish. Slopes 6% and greater shall be heavy broom slip resistant. Concrete finish to be stable, firm and slip resistant per CBC Section 11B-302 and 11B-403.

E. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive hot temperatures. Comply with ACI 305R-10, Guide to Hot Weather Concreting.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days and above 50 deg. F.

C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

D. Curing Method: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and/or by combinations thereof, at contractor's option except as noted during hot weather.

E. Cold Weather Requirements: Protect concrete from freezing conditions during the first seven (7) days after placement.

F. Hot Weather Requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods.

3.10 REMOVAL OF FORMS:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

3.11 RE-USE OF FORMS:

A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.12 MISCELLANEOUS CONCRETE ITEMS:

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

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

C. Equipment and Enclosure Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Owner's Representative.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar, colored to match surrounding surfaces after bonding compound has dried. Surfaces exposed-to-view shall be sacked with colored mortar as directed by Owner's Representative.

C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner's Representative. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning.

D. Flush out form tie holes, fill with dry pack mortar.

E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

G. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions. Color of repair shall match surrounding surface color.

H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

I. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Owner's Representative.

J. Repair methods not specified above may be used, subject to acceptance of Owner's Representative.

3.14 WATERPROOFING SITE RETAINING WALLS:

A. Contractor shall apply waterproof membrane to site retaining walls. Membrane shall continuously cover the surface in contact with soil, vertically from the footing to 2" above the finished grade level of the soil retained.

B. Prepare surface as recommended by manufacturer by filling cracks, priming, filling joint and voids, penetrations and corners.

C. Apply waterproof membrane as recommended by manufacturer.

3.15 SACK FINISH WALLS, STEP SEATING AND CURBS

A. Sack finish shall consist of filling holes or depressions in the surface of the concrete, repairing all rock pockets, removing fins, and removing stains and discolorations visible from traveled ways. Sack finish, unless otherwise specified, shall be considered as a final finish where designated on the plans and details.

B. Except as provided herein, form bolts and any metal placed for the convenience of the Contractor shall be removed to a depth of at least one inch below the surface of the concrete. All rock pockets and other unsound concrete shall be removed. The resulting holes or depressions shall be cleaned and filled with mortar. Form bolts projecting into the cells of box girders need not be removed unless deck forms are removed from the cells, in which case the bolts shall be removed flush with the surface of the concrete.

C. Mortar used to fill bolt holes shall conform to the provisions in this Section for "Mortar." Other depressions and pockets shall be filled with packed mortar as directed by the Architect and the mortar shall be cured in conformance with the provisions in this Section.

D. For exposed surfaces, integral concrete color (LM Scofield Chromix) cement shall be added to the mortar in an amount sufficient to result in a patch which, when dry, matches the surrounding concrete.

E. If rock pockets, in the opinion of the Architect, are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, the Architect may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. The Owner will employ a testing laboratory to perform other tests and to submit test reports.

B. Reinforcing steel shall be supplied with heat number and mill analysis per ACI 318-89.

C. Shrinkage Limitation: All concrete shall meet drying shrinkage limitations as follows:

D. 0.032 percent at age 21 days, with tolerance of +25% for specimens taken during the course of the work.

E. The use of aggregates with a proven history of compliance with the above limitations will be accepted as fulfilling this requirement. In the absence of satisfactory evidence, the laboratory shall prepare specimens (4" x 4" prisms 10" gage length, ASTM C-157-64T) and test for compliance prior to approval.

PROJECT CLOSE-OUT:

END OF SECTION 32 13 13

SECTION 32 17 00 - PAVEMENT SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Parking lot striping.
B. Disabled loading zone striping and disabled parking symbol.
C. Traffic symbols.
D. Curb painting.
E. Traffic and parking control signage.
F. Sport Court striping.

1.2 RELATED SECTIONS

A. Section 32 12 16 - Asphalt Pavement.
B. Section 32 13 13 - Concrete Paving.
C. Section 10 14 00 - Signage.

1.3 QUALITY ASSURANCE

A. Materials and work of this section shall conform with Local Municipality Public Works standards and specifications.

1.4 REGULATORY REQUIREMENTS

A. Conform to regulations of Bay Area Air Quality Management District and California Air Resources Board regarding use of paint.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do no painting when surface and air temperatures are below 40 degrees F or below those temperatures recommended by the paint manufacturer.

PART 2 - PRODUCTS

2.1 STANDARD CATALOG PRODUCTS

A. Symbol Marking Paint and Traffic Marking Paint: Water borne product conforming to State Specification 8010-426-30; Dunn-Edwards Traffic Paint W801, Sinclair 160

Vinyl Traffic Paint, or equal product.

1. ISA Symbol Background: Color - Blue. Size: As indicated in the drawings.

2. Parking Stall Striping, Traffic Symbols and Disabled Loading Zone Striping and Lettering: Color - White. Width for all striping: Three inches, or as indicated in the drawings. Blue border around access aisle.

3. Disabled Stall Curbs: Color - Blue. Width for all striping: Three inches, or as indicated in the drawings.

4. Sport Court Striping: Color - White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine receiving surfaces and verify that surfaces are proper for installation.

B. Do not start work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, oil, grease, and other foreign matter from the areas of the pavement and curbs to be painted.

B. Do not apply traffic paint to surfaces which are excessively dirty, damp, and cold.

3.3 INSTALLATION

A. Apply parking lot as a 4 inch wide solid line. Apply loading zone striping as 8 inch wide solid line.

B. Stripe parking stalls to the dimensions as shown on the Drawings; traffic symbols shall be as shown. Stripe loading zone to dimensions shown on Drawings.

C. Paint the ISA parking symbol in each accessible parking stall as indicated on the Drawings and in accordance with the American National Standard Institute Figure A117.1.

D. Paint horizontal and vertical face of curbs abutting accessible parking stalls. See Drawings for extent of painted curbs.

E. Apply traffic paint with atomizing spray type striping machine equipped with separate thermostatically controlled heating devices for each paint pot and capable of applying paint whereby the lines and markings have clear-cut edges, true and smooth alignments and uniform thicknesses.

F. Apply paint with completed lines and marking clean, sharp and to dimensions.

1. Ragged ends of segments, fogginess along the sides or objectionable dribbling of paint along the unpainted portions of the strips will not be permitted.

2. The finished paint shall have an opaque, well painted appearance with no black or other discolorations showing through.

G. Set posts for parking sign plumb in minimum 12 inch diameter concrete footings with top of footing 6 inches below finished grade and bottom of footing minimum 36 inches below finished grade. Slope top of concrete for water runoff. Cap top of pipe.

H. Secure signs to posts with saddles and vandal-proof nuts.

I. Install parking control signs with bottom of upper sign 60 inches above finished grade. Install accessible parking signs with bottom of upper sign 80 inches above finished grade. Install lower signs in two sign assemblies with top within 1 inch of bottom of upper sign.

3.4 PROTECTION

A. Exercise reasonable precautions to protect the paint, as applied, during drying time. Remove objectionable tracking.

END OF SECTION 32 17 00

SECTION 32 17 25 - CAST-IN-PLACE TACTILE WARNING SURFACE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Cast-in-place Tactile Waring Surface (non-replaceable)
   2. Radius Cast-in-place Tactile Waring Surface

1.3 SUBMITTALS:

A. Submit list of materials proposed for use in work, in form of shop drawing, identified by manufacturer’s name and product label prior to start of installation.

B. Submit samples of colors and finishes. Obtain selection colors before proceeding with work.

C. Product Data - Submit material specifications, manufacturer's installation, and maintenance instructions.

D. Samples: Partial Unit with exposed finish for acceptance. Accepted unit will serve as standard of quality and workmanship for production units.

E. Certification: Manufacturers certifications that all products furnished meet or exceed specified requirements.

1.3 REQUIREMENTS

A. Material must comply with local, state, and federal air pollution control requirements and federal lead content requirements.

B. Material must comply with California State Accessibility Standards, CCR Title 24.

C. Material must comply with Americans With Disabilities Act (ADA) Accessibilities Guidelines for Buildings.

1.4 QUALITY ASSURANCE

A. Manufacturer: Colors selected are from a single manufacturer.

B. Tile shall comply with requirements of Detectable Warnings on Walking Surfaces, of the Americans With Disabilities Act and California State Accessibilities Standards, Title 24.

1.5 PRODUCT HANDLING

A. Protection: Products to be stored at the job site in a safe dry place with all labels intact and legible at time of installation.

B. Replacements: In the event of damage, make repairs and replacements.

C. Delivery and Handling: Deliver units to site at scheduled time of installation, and handled at the job site in the protective, shrink-wrapped pallets. Pallets shall be stored complete and unopened until time of use so that the units will not be discolored or soiled before installation and should be re-covered at the end of each workday.

D. Transport: Transport units in manner so as to prevent, cracking, or spalling. Plastic sheeting protection covers required for shipping and delivery.

1.6 REGULATORY REQUIREMENTS

A. Detectable warnings surfaces shall comply with CBC Section 11B-705.1.

B. Detectable warning surfaces shall be yellow conforming to FS 33538 of SAE AMS-STD 595A. CBC Sections 11B-705.1.1.3 and 11B-705.1.1.5.

C. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. CBC Section 11B-705.1.1.4.

D. Provide minimum 5 year warranty

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Cast-in-place Tactile Warning Surface: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. ADA Solutions, LLC; Toll Free Tel: (800) 372-0519. 323 Andover Street – Suite 3 Wilmington, MA 01887 ***(Basis of Design)***
   2. Armor-Tile (800) 682-2525. Engineered Plastics, 300 International Dr, Suite 100, Williamsville, NY 14221

3. Vitrified Polymer Composite (VPC) Cast In Place Detectable/Tactile Warning Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. (800-682-2525).
4. Or equal (Reference substitution requirements in Division 1)

B. Dimensions
1. Tile shall contain truncated domes with a diameter of nominal 0.9" – 0.92" at base tapering to 0.45" – 0.47" at the top, a height of nominal 0.2 inch and a center to-center spacing of nominal 1.67 inches.
2. Size:
a. Cast-in-place panels shall be ¼" nominal thickness with 1.375 inch embedment ribs at 3" o.c. through the entire tile length .24 inches x 24 inches x 2 inches thick
b. Available Sizes: Use sizes to keep the minimize the number of panels required.
i. 12 inches x 12 inches
ii. 24 inches x 48 inches
iii. 24 inches x 60 inches
iv. 36 inches x 48 inches
v. 36 inches x 60 inches
3. Coefficient of friction shall be 0.6 minimum when tested in accordance with ASTM C 1028.
4. Consistent color throughout tile. Cure units to develop concrete quality and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
5. Units exhibiting evidence of extensive repairs will not be accepted.

C. MATERIALS:
1. Homogeneous glass, carbon and reinforced composite material with embedment ribs for structural support.

2.2 COLOR SELECTIONS:

A. Color selected Shall be Federal Yellow

2.3 SOURCE QUALITY CONTROL AND TESTING

A. Testing: sampling and testing in accordance with manufactures standard procedures, subject to the engineer's acceptance.

PART 3 EXECUTION

3.1 GENERAL

A. Install truncated domes in conformance with manufacturer's specifications and substrate requirements.
   1. Verify layout of work before beginning work.
   2. Verify substrate is acceptable for placing units in place.
   3. Beginning of work means acceptance of existing conditions.

3.2 INSTALLATION

A. Spread and screed mortar setting bed mixture true to plane. Limit setting bed to one tile prior to initial set.

B. Set and level each tile immediately. Tamp tiles to complete contact with setting bed. Do not set large areas of tiles for later leveling.

C. Remove excess mortar from face of tiles as work progresses while mortar is fresh.

D. Replacement: Replace tile work showing damage or disfiguration during progress of work in its entirety. Patching or hiding of defects is not permitted.

3.3 GROUTING AND CLEANING

A. Grouting: Grout joints as soon as initial set or setting bed is achieved.

B. Cleaning: Remove grout haze with manufacturer approved cleaner.

3.4 SEALANT

A. Seal with two coats of manufacturers sealing product or product designated by manufacturer designed for precast concrete penetration.

B. Sealant shall protect units against all weather conditions

C. Sealant shall protect units against graffiti.

D. Coefficient of friction of 0.6 shall be maintained.

3.5 PROTECTION

A. Protect surfaces and objects adjacent to work area, grounds, lawns, shrubbery, and adjacent properties against damage. Be responsible for storage of materials, removal of combustible rags, empty containers, etc., at end of each day, taking every possible precaution to prevent fire.

END OF SECTION 32 17 26

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Swing gates.
3. Privacy slats.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Accessories: Privacy slats.
d. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence, and gate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.

a. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed 8 feet for Material Group IA, ASTM F 1043, Schedule 40 steel pipe
b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

B. Pedestrian Gates:

1. All pedestrian gates are to comply with the 2022 California Building Code CBC 11B-404 unless otherwise indicated.
2. All pedestrian gates are to be sized between 36- and 48-inches opening width unless otherwise indicated.
3. All latches are to be rated for accessibility and compliant with the 2022 California Building Code CBC 11B-309.4.

C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 0.148 inch (3.76 mm).
    a. Mesh Size: 1-3/4 inches (44 mm) .
    b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. (610 g/sq. m) with zinc coating applied before weaving.
    c. Polymer-Coated Fabric: ASTM F 668, Class 1 over zinc -coated steel wire.
        1) Color: As selected by Architect from manufacturer's full range, according to ASTM F 934.
    d. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings <Insert dimension>.
    a. Maximum Height: 8 feet above adjacent grade.
2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
    a. Line Post: 2.375 inches (60 mm) in diameter.
    b. End, Corner, and Pull Posts: 2.875 inches (73 mm) in diameter.
3. Horizontal Framework Members: Intermediate top and bottom rails according to ASTM F 1043.
    a. Top Rail: 1.66 inches (42 mm) in diameter.
4. Brace Rails: ASTM F 1043.
5. Metallic Coating for Steel Framework:
    a. Type A: Not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating according to ASTM A 653/A 653M.

6. Polymer coating over metallic coating.

    a. Color: Match chain-link fabric, according to ASTM F 934.

2.4 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:

1. Type II: Zinc coated (galvanized) by hot-dip electrolytic process, with the following minimum coating weight:.

    a. Matching chain-link fabric coating weight.

B. Polymer-Coated Steel Wire: 0.177-inch- (4.5-mm-) 0.148-inch- (3.8-mm-) diameter, tension wire according to ASTM F 1664, Class 1 over zinc-coated steel wire.

1. Color: Match chain-link fabric, according to ASTM F 934.

2.5 SWING GATES

A. General: ASTM F 900 for gate posts and single or double swing gate types.

1. Gate Leaf Width: As indicated.
2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. General: Provide all gates with hardware group No. 11. See Section 08 71 00 Door Hardware.
2. Hardware: Provide hardware in compliance with all egress and accessibility requirements.
3. Hinges: 360-degree inward and outward swing.
4. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.6 FITTINGS

A. Provide fittings according to ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of zinc.

a. Polymer coating over metallic coating.

2.7 PRIVACY SLATS

A. Fiber-Glass-Reinforced Plastic Slats: UV-light-stabilized fiber-glass-reinforced plastic, not less than 0.06 inch (1.5 mm) thick, sized to fit mesh specified for direction indicated, with vandal-resistant fasteners and lock strips.

B. Tubular Polyethylene Slats: Minimum 0.023-inch (0.58-mm)-thick tubular polyethylene, manufactured for chain-link fences from virgin polyethylene with UV inhibitor, sized to fit mesh specified for direction indicated, with vandal-resistant fasteners and lock strips fins for increased privacy factor.

C. Color: As selected by Architect from manufacturer's full range.

2.8 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. 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. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.9 GROUNDING MATERIALS

A. Comply with requirements in Section 260526.

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.

b. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.

c. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches (127 mm) deep and 3/4 inch (20 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more. For runs exceeding 500 feet (152 m), space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 96 inches (2440 mm) o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. As indicated on Drawings.

H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch (50-mm) bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches (380 mm) o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

N. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Diagonally for privacy factor of 80 to 85

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions & 2022 CBC requirements in Chapter 11B-404,, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 26 05 26.

B. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 1500 feet (450 m) <Insert dimension>.
3. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m) <Insert dimension>.
4. Ground fence on each side of gates and other fence openings.

a. Bond metal gates to gate posts.
b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (457 mm) below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet (45 m) on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (152 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

F. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
3. Make above-grade ground connections with mechanical fasteners.
4. Make below-grade ground connections with exothermic welds.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

H. Comply with requirements in Section 26 05 26.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Grounding Tests: Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems"

C. Prepare test reports.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 31 13

SECTION 32 33 00: SITE FURNISHINGS

PART 1 - GENERAL

1.01 PRINCIPAL WORK IN THIS SECTION

A. Furnish and install **Owner's** [redacted]

B. [redacted]

C. [redacted]

D. [redacted]

1. [redacted]
2. [redacted]
3. [redacted]

1.02 REFERENCE STANDARDS

A. [redacted]

B. [redacted]

1. [redacted]

C. [redacted]

D. [redacted]

1. [redacted]

2. [redacted]

E. [redacted]

F. [redacted]

1.03 PERFORMANCE, TESTING AND INSPECTION

A. **General:**

1. [redacted]
2. [redacted]

B. **Sustainability:**

1. [redacted]
2. [redacted]

1.04 SUBMITTALS

A. [redacted]

B. [redacted]

C. [redacted]

1. [redacted]

1.05 QUALITY ASSURANCE

A. [redacted]

B. [redacted] **five (5)** [redacted]

C. [redacted] **five (5)** [redacted]

General Contractor

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

1.07 JOB CONDITIONS

1.08 PROTECTION

1.09 GUARANTEE/WARRANTY

one (1)

Owner

Owner

Owner

Owner.

1.10 RELATED WORK/SECTIONS

1.11 OPERATION AND MAINTENANCE DATA

1.12 SEQUENCING AND SCHEDULING

PART 2 - PRODUCTS

2.01 MANUFACTURERS

2.02 MATERIALS

	6’-0”
	9”
	4.5”
	5” wide top after sides taper
	Drive anchor into substrate thru each of the precast ¾” diameter holes
	Drill holes into substrate to set 5/8” dia. rebar into two part epoxy

				1/8”
				1/8”
				1/8”
				1/8”
				1/8”
				1/8”
				1/8”
				1/2”
				1/2”
			2” Bullnose	1”
			1/2” Bullnose	1.25”
			3” Bullnose	1.50”
			6” Bullnose	3”
				½”
				¼”
				½”

24” o.c. maximum and evenly spaced with joints

Per mfgr’s recommendations

2.03 OTHER MATERIALS

PART 3 - EXECUTION

3.01 INSPECTION / EXAMINATION

3.02 COORDINATION

3.03 PREPARATION

Prepare work, substrates, etc. in accordance with manufacturer’s recommendations.

3.04 INSTALLATION

Perform work in accordance with manufacturer’s recommendations, as herein specified and

Drill hole into concrete to set a 5/8” dia. anchor flush with top of wheel stop.

3.05 PROTECTION AND CLEAN UP

Perform work in accordance with manufacturer’s recommendations, as herein specified and in

END OF SECTION

SECTION 33 40 00 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes gravity site storm sewerage drainage piping, fittings and accessories, and bedding; bio-retention facilities connection of drainage system to municipal sewers and on-site points of connection; and catch basins, area drains, and cleanouts.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 23 00 - Excavation.
3. Section 31 23 16.13 - Trenching.
4. Section 31 23 23.13 - Backfill.
5. Section 33 30 00 - Sanitary Sewerage Utilities.
6. Section 33 49 13 - Storm Drainage Manholes, Frames, and Covers.

1.2 REFERENCES

A. AASHTO M36 (American Association of State Highway and Transportation Officials) - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.

B. ASTM A74 - Cast Iron Soil Pipe and Fittings.

C. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

D. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

E. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.

F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

H. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

J. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

K. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

L. ASTM D7613 – Polypropylene Liner.

M. Class II Permeable Materials – To meet the requirements of Caltrans Standard Specification 68-1.025.

N. ASTM D6707 – Mirafi Filter Fabric.

1.3 SUBMITTALS

A. Section 01 34 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating pipe, pipe accessories, and fittings.

C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Requirements.

B. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

C. Operation and Maintenance Data: Procedures for submittals.

1.5 COORDINATION

A. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, municipal sewer utility service, and on-site points of connection.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sewer Pipe Materials:

1. Cast Iron Pipe: ASTM A74, Service type, inside nominal diameter of 4 to 12 inches, bell and spigot end.

2. Cast Iron Pipe Joint Device: ASTM C564, rubber gasket joint devices.

3. Concrete Pipe: ASTM C14, Class 3; unreinforced; inside nominal diameter of 10 inches, bell and spigot end joints.

4. Concrete Pipe Joint Devices: ASTM C443, rubber compression gasket joint.

5. Reinforced Concrete Pipe: ASTM C76, Class III or IV; inside nominal diameter of 12 to 60 inches, bell and spigot end joints.

6. Reinforced Concrete Pipe Joint Device: ASTM C443, rubber compression gasket joint.

7. Plastic Pipe: ASTM D2751, SDR 26, Acrylonitrile-Butadiene-Styrene (ABS) material; inside nominal diameter of 4 to 24 inches, bell and spigot style solvent sealed joint end.

8. Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) SDR-26 material; inside nominal diameter of 4 to 24 inches, bell and spigot style rubber ring sealed gasket joint.

9. Corrugated Steel Pipe: AASHTO M36; nominal diameter of 12 to 60 inches, end joints; helical lock seam; coated inside and out with 0.050 inch thick bituminous coating.

10. Corrugated Steel Pipe Coupling Bands: Galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

11. Perforated Plastic Pipe: ASTM D3034, PVC with perforations.

B. Liner:

1. 30 mil polypropylene liner.

2.2 ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

B. Grout: Specified in Section 03 30 00.

2.3 CATCH BASINS AND PLANT AREA DRAINS

A. NEW - As specified on the drawings.

B. EXISTING – Adjust as specified on the drawings. For inlets in pedestrian areas, ensure grates are ADA compliant. Replace non-compliant grates as necessary.

2.4 CLEANOUTS

A. As specified on the drawings.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: Fill as specified by pipe manufacturer and approved by Soils Engineer.

B. Cover: Fill as specified in the project Soils Report and any supplements to the Soils Report.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordination and project conditions.

B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 16.13 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings with maximum variation from true slope of 1/8 inch in 10 feet.

C. Perforated pipe shall be installed with perforations down.

D. Install trench fill at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent.

E. Refer to Section 31 23 23.13 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

F. Refer to Section 33 49 13 for manhole requirements.

3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 INSTALLATION – BIO-RETENTION FACILITIES

A. Form bottom of excavation smooth to correct elevation.

B. Install welded seam 30 mil polypropylene liner in basin bottom.

C. Install Class II permeable material minimum 2" under perforated pipe.

D. Install remainder of Class II permeable material.

E. Install Mirafi Filber Fabric over permeable materials.

F. Install top soil.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

C. Compaction testing will be performed in accordance with ASTM D1557.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to owner.

3.8 INSTALLATION, FLUSHING & CLEANING

A. All new pipe installed and existing pipe connected to shall be flushed, cleaned and videoed for at least 200 feet downstream, or to the next downstream inlet or manhole, whichever is farther, of last point of connection to ensure clean and functioning system.

3.9 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
   1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
   2. Where pipe is damaged or displaced, take remedial measures as directed by the Architect/Engineer including, but not limited to, retesting of joints, relaying pipe or replacing pipe. Provide remedial measures at no additional cost to the Owner.

END OF SECTION 33 40 00

SECTION 33 49 13 - STORM DRAINAGE MANHOLES, FRAMES, AND COVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Modular precast concrete manhole sections with tongue-and-groove joints, covers, anchorage, and accessories.

B. Related Sections:
   1. Section 31 23 00 - Excavation and Fill.
   2. Section 31 23 23.13 - Backfill.

1.2 REFERENCES

A. ACI (American Concrete Institute) 318 - Building Code Requirements for Reinforced Concrete.

B. ASTM A48 - Gray Iron Castings.

C. ASTM A536 - Ductile Iron Castings.

D. ASTM C39 - Test Method for Compressive Strength of cylindrical Concrete Specimens.

E. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

F. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

1.3 DESIGN REQUIREMENTS

A. Equivalent strength shall be based on structural design of reinforced concrete as outlined in ACI 318.

B. Design of lifting devices for precast structures shall conform to ASTM C 913.

C. Design of joints for precast structures shall conform to ASTM C 913.

1.4 SUBMITTALS

A. Section 01 34 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate manhole locations, elevations, piping, and sizes and elevations of penetrations.

C. Product Data: Submit manhole covers, component construction, features, configuration, and dimensions.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with local municipality Public Work's standard.

B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 63 10 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer’s instructions for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to the Owner’s property or other public or private property, and any property so damaged shall be repaired at the Contractor’s expense.

D. Clearly mark each precast structure by indentation or waterproof paint to indicate the date of manufacture, manufacturer and identifying symbols and/or numbers shown on the Contract Drawings to indicate its intended use.

PART 2 - PRODUCTS

2.1 MANHOLES, FRAMES, AND COVERS

A. As specified by the local municipality.

2.2 COMPONENTS

A. As specified by the local municipality.

2.3 CONFIGURATION

A. As specified by the local municipality.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordination and Project Conditions.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into Work.

D. Verify excavation for manholes is correct.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures under site conditions known to result in loads heavier than that for which the structure was designed.

C. Inspect precast concrete structures immediately prior to placement in the excavation to verify that they are internally clean and free from damage. Remove damaged units from the construction site and replaced, at no additional cost to the Owner.

3.3 INSTALLATION

A. Excavation and Backfill:
   1. Excavate for manholes and drainage structures in accordance with Section 31 23 00 in the location and to depth shown. Provide clearance around the sidewalls of the structure as required for construction.
   2. If groundwater is encountered, prevent accumulation of water in excavations. Place manholes or drainage structures in a dry trench.
   3. Where the possibility exists of a watertight structure becoming buoyant in a flooded excavation, take necessary steps to avoid flotation of the structure.

B. Place base pad, trowel top surface level.

C. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

D. Backfill excavations for manholes and drainage structures in accordance with Section 31 23 00.

E. Form and place manhole cylinder plumb and level, to correct dimensions and elevations.

F. Cut and fit for pipe.

G. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

H. Set cover frames and covers level without tipping, to correct elevations.

I. Coordinate with other sections of Work to provide correct size, shape, and location.

3.4 PRECAST CONCRETE MANHOLE AND DRAINAGE STRUCTURE INSTALLATION

A. To ensure safety, lift precast structures at the lifting points designated by the manufacturer.

B. When lowering manholes and drainage structures into the excavations and joining pipe to the units, take precautions to ensure that the interior of the pipeline and structure remains clean.

C. Set precast structures so that they firmly and fully bear on crushed stone bedding, compacted in accordance with the provisions of Sections 31 23 00 and 31 23 23.13, or on other support system shown on the Contract Drawings.

D. Assemble multi-section structures by lowering each section into the excavation. Lower, set level, and firmly position the base section before placing additional sections.

E. Ensure joint integrity by removing all foreign materials from joint surfaces and verifying that sealing materials are placed properly. Avoid misalignment by using guide devices affixed to the lower section.

F. Joint sealing materials may be installed at the site or at the manufacturer's plant.

G. Verify that manholes and drainage structures installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping so as not to create openings more than that required to receive pipe. Fill annular space with mortar.

I. Cut pipe to finish flush with interior of structure.

J. Shape inverts through manhole as shown on the Contract Drawings.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Field tests will be used to evaluate and approve cast-in-place.

C. Vertical Adjustment of Existing Manhole and Drainage Structures:
1. Where required, adjust the top elevation of existing manholes and drainage structures to suit finished grades shown on the Contract Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of all mortar fragments, to the required elevation in accordance with the requirements specified for installation of castings.
3. Remove the concrete so as not to damage the existing vertical reinforcing bars when removal of an existing concrete wall is required. The vertical bars shall be cleaned of all concrete and bent into the new concrete top slab or spliced to required vertical reinforcement, as shown on the Contract Drawings.
4. Clean and apply sand-cement bonding compound on all existing concrete surfaces to receive cast-in-place concrete. Sand-cement bonding compound and its application shall be in accordance with Section 03 30 00.

END OF SECTION 33 49 13