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:

RIO VISTA ELEMENTARY

Project #23118.01

SPECIFICATIONS

DSA SUBMITTAL

DSA APPLICATION NO.: 01-121440
FILE NO.: 07-29

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ARCHITECTS

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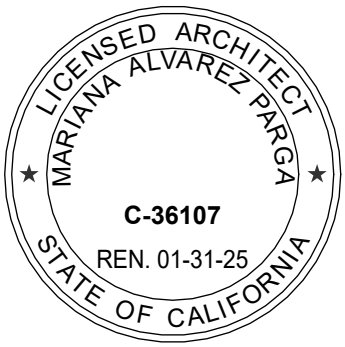









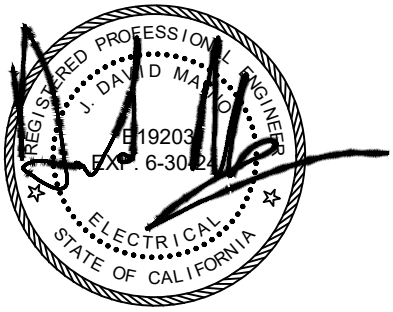



SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 & 01 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 1704.1

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Rio Vista Elementary School Campus Modernization

B. Project Location: Rio Vista Elementary School

C. Owner/ District: Mt Diablo Unified School District

D. Architect:19/six.

E. The Work consists of the following:

1. GENERAL ALTERATION OF CLASSROOM BUILDINGS 3, 4, 6, 8, 9 AND 10 CONSISTING OF:
   a. RECONFIGURATION/ACCESSIBILITY UPGRADES AT RESTROOMS IN BUILDINGS 8 & 9.
   b. FLOORING IN-KIND REPLACEMENT
   c. FLOORING REPLACEMENT WITH NEW MATERIAL
   d. NEW CASEWORK WITH NEW ACCESSIBLE SINKS
   e. NEW LIGHTING
   f. NEW INTERIOR AND EXTERIOR PAINTING
   g. REPLACEMENT OF GLUE-UP TILES WITH NEW CEILING
   h. REPLACEMENT OF TACKABLE BOARDS
   i. REPLACEMENT OF ALL EXTERIOR DOORS WITH NEW FRP DOORS
   j. HARDWARE REPLACEMENT AT ALL EXTERIOR DOORS
   k. WINDOWS AND CLERESTORY REPLACEMENT WITH NEW
   l. REPLACEMENT IN-KIND OF HVAC EQUIPMENT IN SOME BUILDINGS, EQUIPMENT TUNE-UP IN OTHERS.
2. ACCESSIBILITY UPGRADES
   a. NEW OUTDOOR DRINKING FOUNTAINS WITH WATER BOTTLE FILLER
   b. ACCESSIBILITY UPGRADES AT KINDERGARTEN CLASSROOMS
   c. ACCESSIBILITY UPGRADES AT PARKING LOT, DROP-OFF AREA, AND CONCRETE WALKWAYS.

3. The intent of these drawings and specifications is that the new construction in this contract is to be in accordance with Title 24, California Code of Regulations.

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 three phases.

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.
   a. Schedule deliveries to minimize use of driveways and entrances.
   b. 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.
      a. 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 items are listed on Drawings.

B. 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):
      a. 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.
      b. 1 set of reproducible shop drawings each submittal review.
      c. 1 set of reproducible shop drawings for each plan check review.
      d. 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. 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.

6. Construction Change Document (Section 4-338 (c), Part 1) must be signed by all the following:
   a. A/E of Record.
   b. Owner (change order only).
   c. SEOR (when applicable).
   d. Delegated Professional Engineer (when applicable).
   e. DSA.
7. Project Inspector and testing lab must be employed by the Owner and approved by all of the following:
   a. A/E of Record.
   b. SEOR (when applicable).
   c. DSA.

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, sighed 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 "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. 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 1 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

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), 2022 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 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 1 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 16 43, Gypsum Sheathing
      a. Adhesive applied on-site
   2. Section 06 20 00, Finish Carpentry
      a. Adhesive applied on-site
      b. Composite wood products containing added urea-formaldehyde
   3. Section 06 41 00, Architectural Wood Casework
      a. Adhesive applied on-site
      b. Composite wood products containing added urea-formaldehyde
   4. Section 07 25 00, Weather Barriers
      a. Adhesives
      b. Sealants
   5. Section 07 92 00, Joint Sealers
      a. All joint sealers applied on-site on the interior side of the building envelope
   6. Section 08 14 16, Flush Wood Doors
      a. Adhesives applied on-site
      b. Composite wood products containing added urea-formaldehyde

7. Section 09 21 16, Gypsum Board Assemblies
    a. Adhesives
    b. Sealants
8. Section 09 30 13, Ceramic Tile
    a. Adhesives and joint sealers applied on-site on the interior side of the building envelope
    b. Sealants
9. Section 09 65 00, Resilient Flooring
    a. Adhesives
    b. Sealants
10. Section 09 91 00, Painting and Coatings
    a. Painting
    b. Coatings
11. Section 10 21 13 Operable Partitions
    a. Adhesives
    b. Sealants

B. Porous and Fibrous Materials
1. Section 07 21 11, Thermal Installation
2. Batt insulation (exposed to interior only)
3. Section 09 51 00, Acoustical Ceiling-Lay-In

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 voe-Emitting Materials identified in paragraph 1.04 of 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 paragraph 1.03 of this Specification are applied on-site, apply prior to installation of Porous and Fibrous Materials as identified in paragraph 1.04 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 paragraph 3.06 of 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 (as described in paragraph 1.04 above} 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 00 - GENERAL COMMISSIONING

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. 23 08 00 Commissioning of HVAC Systems

1.2 DESCRIPTION OF WORK

A. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. The Commissioning Authority (CA) will be directly hired by the Owner. The General Contractor that is awarded the project shall not include the cost of the Commissioning Authority in their price. The general contractor (and their sub-contractors) shall include cost for their involvement in the commissioning process as described in this section and other related commissioning sections, including completion of system readiness checklists, and demonstration of installed equipment to the commissioning team members during the functional performance testing portion of the project.

C. Commissioning during the construction phase is intended to enhance the quality of system start-up and aid in the orderly completion and transfer of systems for beneficial use by the owner. The following objectives will be documented accordingly:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted standards, that they meet design intent, and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation left on site is complete.
4. Verify that the Owner's operating personnel are adequately trained.

D. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished product, installed and fully functional in accordance with the contract documents.

1.3 ABBREVIATIONS

A. The following are common abbreviations used in the Specifications and in the Commissioning Plan.

	owner's representative)		

1.4 DEFINITIONS

A. Commissioning Plan: An overall plan that provides the structure, schedule and coordination planning for the commissioning process.

B. Deferred Functional Tests: FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

C. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

D. Design Narrative: Sections of either the Design Intent or Basis Of Design which describe the systems operation and principle function

E. Functional Performance Test (FT): Test of the dynamic function and operation of equipment and systems using direct observation or monitoring methods. Functional testing is the dynamic testing in all modes of systems (rather than just components) under full operation (e.g. the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set point). The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. Functional performance tests shall demonstrate the correct installation and operation of each component, system, and system-to-system interface in accordance with the approved plans and specifications. Functional performance testing reports shall contain information addressing each of the building components tested, the testing methods utilized, and include any readings and adjustments made.

F. Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation).

G. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

H. Seasonal Performance Tests: FT that are deferred until the system(s) will experience conditions closer to their design conditions.

I. Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

J. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

K. Systems Manual: Documentation of the operational aspects of the building shall be completed within the systems manual and delivered to the building owner or representative/operator

L. System Readiness Checklist (SRC): A checklist developed by the CA and provided to the contractor for execution. Completion of this checklist verifies the system or component has been installed in accordance with design documents and IOMs. This checklist is required before commencing functional testing. The signee for a specific contractor section in a SRC will be the same throughout the project (e.g. only one person will sign for the MC).

M. Testing Coordinator (TC): Commissioning Team member appointed by GC. TC's roles include distribution of SRCs between Subs & CA, ensure execution & completion of SRCs by Subs, collect/review completeness of SRCs for final delivery to CA, coordinate scheduling of functional tests, collect all required documents (eg O&Ms, training plans, etc) and deliver to the CA. The TC must be familiar with all of the commissioned equipment and possess good organizational skills.

1.5 COMMISSIONING PROCESS

A. The following activities describe the commissioning tasks during construction and the general order in which they occur. The CA coordinates all activities.

B. Scoping Meeting: All members of the design and construction team that will be involved in the commissioning process meet and agree on the scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the Commissioning Plan.

C. Commissioning Plan: The Commissioning Plan provides guidance in the execution of the commissioning process. The Specifications take precedence over the Commissioning Plan.

D. Submittals: Equipment documentation is submitted within 30 days of approval to the CA, including detailed start-up procedures.

E. Start-Up/System Readiness Checklists (SRC): The CA works with the Subcontractors to develop startup plans and documentation formats, including providing the Subcontractors with system readiness checklists to be completed during the startup process.

F. Functional Performance Testing: The CA develops specific equipment and system functional performance test procedures. The Subcontractors review the procedures. The procedures are executed by the Subcontractors, under the direction of, and documented by the CA.

G. Deficiencies and Resolution: The CA documents items of non-compliance in materials, installation or operation. The items are corrected at the Sub's expense and the equipment or systems are retested.

H. Operations and Maintenance Documentation: The CA reviews the Operation and Maintenance documentation for completeness.

I. Training: The CA reviews the training plans and agenda provided by the Subcontractors and verifies that training is completed.

J. Commissioning Report: The CA writes the commissioning report.

1.6 SCOPE OF WORK

A. The following building systems will be included in the commissioning process for the project:

1. Division 23 (Heating Ventilation and Air Conditioning)

1.7 COMMISSIONING TEAM

A. The members of the commissioning team consist of the following members:

1. Commissioning Authority (Agent) (CA)
2. Owner's Project Manager (PM)
3. General Contractor (GC or Contractor)
4. Architect and Design Engineers (particularly the mechanical and electrical engineers)
5. Mechanical Contractor (MC)
6. Test and Balance contractor (TAB)
7. Controls Contractor (CC)
8. Any other installing subcontractors or suppliers of equipment
9. Owner's maintenance personnel
10. Inspector of Record

1.8 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. General

1. The CA, as leader of the commissioning team, directs and coordinates the commissioning activities in conjunction with the General Contractor. All members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

2. Within 30 days prior to equipment startup, the CA will schedule and conduct a commissioning scope meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. CA will revise the Commissioning Plan to its "final" version from information gathered at the meeting and will distribute to all parties.
3. The CA will work with the CM & GC according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the CM & GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner to expedite the commissioning process.
4. The CA will provide the initial schedule of primary commissioning events at the commissioning scope meeting. The Commissioning Plan provides a format for this schedule, as included in the Cx Plan. As construction progresses, more detailed schedules will be developed by the GC.
5. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA is to develop & coordinate the execution of a testing plan, observe & document performance—that systems are functioning in accordance with the documented design intent & in accordance with the contract documents. The Contractors will provide all tools or the use of tools to start, check-out & functionally test equipment and systems.
6. The CA will not release, revoke, alter, or enlarge on requirements of design documents.
7. The CA will not directly approve or accept any portion of construction work.

B. Construction and Acceptance Phase

1. Coordinates and directs the commissioning activities in a logical, sequential & efficient manner using consistent protocols and forms, centralized documentation, clear & regular communications & consultations with all necessary parties, frequently updated timelines & schedules and technical expertise.
2. Coordinate the commissioning work and, with the GC & CM, ensure that commissioning activities are being scheduled into the master schedule.
3. Revise the Commissioning Plan as required.

4. Plan and conduct a commissioning scoping meeting & other commissioning meetings as necessary.
5. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
6. Before startup, gather & review the current control sequences & interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
7. Write and distribute System Readiness Checklists.
8. Perform site visits to observe component & system installations as needed.
9. Approve SRCs and their completion as submitted by TC for CA's review. CA shall perform selected site observation and spot checking as needed.
10. Review TAB execution plan.
11. Approve air and water systems balancing by spot testing, reviewing completed reports and by selected site observation.
12. Create the FT procedures for equipment and systems with input & review by GC/Subs. Submit to CM for review, and for approval if required.
13. Coordinate, witness and approve manual FT performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
14. Maintain a master deficiency and resolution log. Provide the CM with written progress reports and test results with recommended actions.
15. Compile and maintain a commissioning issues log.
16. Provide a final commissioning report.
17. Throughout the commissioning process, document that equipment and systems are installed and perform in accordance with design documents.

1.9 DESIGN TEAM RESPONSIBILITIES

A. Construction and Acceptance Phase

1. Attend the commissioning scope meeting.
2. Attend selected commissioning team meetings.
3. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
4. Provide any design narrative documentation requested by the CA.
5. Review construction and issue punch lists as required.

6. Provide design intent and sequence of operation documentation as required by the CA.
7. Assist and Coordinate resolution of system deficiencies identified during commissioning or review, according to the contract documents.
8. Approve TAB report prior to distribution to the CA.
9. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals.
10. Review and approve the O&M manuals.

1.10 OWNER'S REPRESENTATIVE (PM) RESPONSIBILITIES

A. Construction and Acceptance Phase

1. Manage the contract of the CA
2. Facilitate the coordination of the commissioning work by the CA.
3. Ensure with CA & GC that commissioning activities are being scheduled into the master schedule.
4. Review the final Commissioning Plan.
5. Attend commissioning scope meeting and other commissioning team meetings.
6. Furnish to CA copies of all construction documents, addenda, change orders for commissioned equipment.
7. Review and approve CA generated FT procedures prior to testing.
8. Observe SRC completion & FT's for systems to be commissioned.
9. Review commissioning progress and deficiency reports.
10. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
11. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
12. Assist the GC in coordinating the training of owner personnel.
13. Provide required IP addresses to controls contractor for setting up remote access to controls systems.

1.11 GENERAL CONTRACTOR (GC) RESPONSIBILITIES

A. Construction and Acceptance Phase

1. Facilitate the coordination of the commissioning work by the CA.

2. Ensure with CA that commissioning activities are being scheduled into the master schedule.
3. Appoint TC for management of SRCs.
4. Include the cost of commissioning in the total contract price. Include all special tool and instruments (only available from vendor, specific to a piece of equipment) required for testing in base bid price.
5. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
6. Provide a copy of O&Ms, startup reports, TAB reports, and any other necessary documents for commissioned equipment to the CA.
7. Provide submittals for systems to be commissioned to the engineer of record and the CA.
8. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
9. Provide equipment sequences of operation and final calibration point to point reports to the CA.
10. Ensure that all Subs execute their commissioning responsibilities according to the contract documents and schedule.
11. Attend commissioning scope meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
12. Coordinate with subs on construction progress & equipment readiness for SRC completion.
13. Coordinate with CA on construction progress & system readiness for FT completion. Provide the CA ten (10) day advance notice so that system start-up and functional testing can begin.
14. Provide input on functional test scripts.
15. Pre-test all systems and equipment using functional test scripts prior to formal testing in presence of commissioning agent.
16. Coordinate with Subs to assist in and execute functional tests for verification by the CA.
17. Resolve system deficiencies identified during commissioning process.
18. Coordinate with Subs to execute re-testing of deficient systems and equipment.
19. Coordinate the training of owner personnel. Submit an owner training plan to the CA for review and approval.

20. Video record training sessions and provide to owner.
21. Provide trend logs from the controls system to the CA for review.
22. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
23. Responsible for certifying that the work is complete and systems are operational according to design documents.
24. Complete CALGreen closeout documentation as required.

1.12 EQUIPMENT SUPPLIERS

A. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

B. Assist in equipment testing per agreements with Subs.

C. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA.

D. Provide equipment sequence of operation and testing procedures as requested by CA.

E. Review test procedures for equipment installed (or started up) by factory representatives.

1.13 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned in this project:

1. HVAC System
2. TAB Verification
3. HVAC Control Systems

1.14 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: Prior to permit issuance, a commissioning plan shall be completed to document how the project will be commissioned. Provided as part of the bid documents, is binding on the Contractor. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The specifications will take precedence over the Commissioning Plan. The commissioning plan shall include the following:

1. General project information
2. Commissioning goals
3. Systems to be commissioned
4. Commissioning team information
5. Commissioning process activities, schedules and responsibilities

B. The Owner Project Requirements and Basis of Design shall be incorporated into the drawings, specifications and other design documents.

C. Commissioning Report: A final summary report by the CA will be provided to Owner. The report will focus on evaluating commissioning process issues. System Readiness Checklists, functional tests and monitoring reports will not be part of the final report. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:

1. Description of Commissioning Scope
2. System Readiness Checklists and Equipment Start-Up
3. Functional Performance Testing Results
4. Training documentation and evaluation
5. Outstanding Issues
6. Recommendations

1.15 SUBMITTALS

A. The CA employs the submittals and IO&Ms to develop the SRCs and FT's. The CA shall review submittals for conformance with construction documents, OPR, & BOD. Submittals provided to the CA must have been approved by the A/E.

B. The A/E will review & approve commissioned equipment submittals for conformance to the contract documents as it relates to the commissioning process, the functional performance of the equipment, & adequacy for developing test procedures. This review shall verify compliance with equipment specifications. The A/E will notify the CM or PM of items missing or areas that are not in conformance with contract documents and which require resubmission.

C. A/E or GC shall provide a complete & approved submittal package to the CA.

D. The CA may request additional design narratives from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided in the specifications.

E. Equipment submittals to the CA do not constitute compliance for O&M manual documentation. The IO&M manuals are furnished separately by the Contractor. CA shall review them for development of the SRCs and FTs. IO&M manuals shall be provided with the approved submittals.

F. Contractor shall provide/submit the following documents to the CA:

1. Revised construction schedule including commissioning tasks.
2. Equipment submittals for all commissioned equipment.
3. Sequences of operation for all commissioned equipment.
4. Control diagrams for all commissioned equipment.
5. Final testing and balancing report.
6. Energy code compliance forms – if applicable.
7. Completed SRCs.
8. Manufacturer IO&Ms for commissioned equipment.
9. Training plan for commissioned systems.
10. As-built control sequences and construction drawings.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. See Schedules on Drawings for equipment data. Furnish and install all equipment in All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. E.G. the MC of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities.

B. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site. Stand-alone data logging equipment used by the CA shall not be subject to this requirement.

2.2 RECORDING

A. The GC shall digitally record the audio and visual of selected trainings:

1. HVAC and Controls

B. An introduction shall be made at the beginning of each recording, identifying what equipment is being illustrated, where it is located and who the trainer is.

C. Recording shall be accomplished with a tripod when possible and performed in an expert manner so that the issues being discussed are clearly illustrated and instructions clearly audible. A high quality camera shall be used and additional light provided if ambient light is insufficient.

D. Media shall be clearly labeled with the equipment, date, trainer and segment duration.

E. The digital visual and audio recording shall be bookmarked at each training with an index/table of contents provided and recorded on the DVD. The bookmarks will clearly indicate which equipment is being presented and the format will allow search and go-to functions for rapidly locating training segments.

F. An original and one copy of the recordings shall be submitted to the OWNER.

PART 3 – EXECUTION

3.1 COMMISSIONING PROCESS

A. The following narrative provides a brief overview of the typical commissioning tasks during design and construction and the general order in which they occur:

1. CA reviews updated OPR, BOD, and design documents to ensure feedback comments have been reviewed.
2. CA develops draft commissioning plan for review by the design team. After the scope meeting, the CA will update the Cx Plan and provide the final plan to the commissioning team.
3. Equipment documentation is submitted to the CA after submittal approval by the A/E.
4. The CA develops the System Readiness Checklists and provides these to the TC to be completed during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with the SRCs being completed before FT's.
6. SRCs will be developed and issued after receipt of A/E approved submittals and IO&Ms by the CA.
7. Commissioning during construction begins with a scope meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
8. TC shall deliver one set of blank SRCs to Subs. TC shall collect all completed SRCs and deliver package to CA.
9. The Subs, under their own direction, execute the system start-ups and their completion on the SRCs. The completed SRCs are returned to the TC to be returned to the CA for review.
10. The CA develops specific equipment and system FT procedures.
11. The FT procedures are executed by the Subs under the direction of the CA and documented by the CA.
12. Items of non-compliance in material, installation or setup are corrected at the Sub's expense (including the CA's time and expenses) and the system is retested. The General Contractor is responsible for collecting cost and expenses for retesting.
13. GC shall bear all costs should the CA receive any incomplete SRCs and the CA is required to complete the SRCs to support the construction schedule.

14. The CA provides functional test forms to the GC for review. Close coordination is especially required between the CA and the CC to ensure successful development of the functional tests.
15. CA witnesses all functional tests executed by the subs under the direction of the CA.
16. Any required re-tests are conducted as determined by the CA. Any associated costs with re-tests, including the CA's time and expenses will be charged back to the GC and may be collected from the subs.
17. Training plans are developed and provided to the Owners representative for review.
18. Training is conducted by the Subs and verified by the CA.
19. Functional tests and training is finished before Substantial Completion.
20. Final commissioning report is written.

3.2 SYSTEM READINESS CHECKLIST

A. Procedure: The following procedures apply to all equipment to be commissioned as listed in the Commissioning Plan. Mechanical, plumbing, & electrical commissioning specification sections describe subcontractor responsibilities.

B. General: The SRC for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system. The SRC is developed as follows:

1. A/E approved submittals are provided to CA by A/E or GC.
2. IO&M manuals provided to CA by GC.
3. CA develops SRCs from IO&Ms and submittal information.

C. Execution of the SRC

1. CA provides SRC to TC.
2. Installing contractor obtains documentation from TC and any specific manufacturer start-up, including checklists from the O&M.
3. TC coordinates execution of the equipment start-up among Subs per construction schedule.
4. Subs complete start-up and complete SRCs.
5. Only individuals that have direct knowledge and witnessed the start-up shall sign and complete the SRC.

6. All completed SRCs are returned to TC to be provided to the CA for review and approval.

D. Deficiencies, Non-Conformance and Approval in Checklists and Startup

1. The Subs shall clearly list any outstanding items of the initial start-up on the SRC.

2. The SRC and any outstanding deficiencies are provided to the CA within one week of test completion.

3. The CA reviews the SRC & shall work with the Subs & vendors to correct and retest deficiencies or uncompleted items at contractor's expense (including CA's time). The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner. Subs shall notify the CA as items have been corrected. Start-up report shall be updated as deficiencies are resolved.

4. Items left incomplete, which later cause deficiencies or delays during functional testing may result in additional costs due to either CA interventions or construction delay liquidated damages to the responsible party. Any SRCs that required CA to complete will result in additional charges to the GC that may be collected from installing sub.

3.3 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.

B. Equipment: The general list of equipment to be commissioned is found in the Commissioning Plan.

C. See Mechanical, plumbing, & electrical commissioning specification sections for Subs responsibilities.

D. Objectives and Scope.

1. The objective of FT's is to demonstrate that each system is operating according to the documented design intent and contract documents. FT's facilitate bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

2. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

E. Development of Test Procedures.

1. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, control sequences and parameters. Each Sub or vendor responsible to execute a test, shall provide assistance to the CA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.

F. Test Methods.

1. FT's and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers.

2. Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged whenever practical.

3. Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

4. Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

5. Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.
6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during completion of the start-up plan.
7. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
8. Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. No sampling by Subs is allowed for SRCs or FT's. Should frequent failures during testing require more troubleshooting than verification, the CA shall stop the testing and require the responsible Sub to perform and document a checkout of the remaining units.

G. Coordination and Scheduling

1. The Subs through the TC shall provide sufficient notice to the CA of their completion schedule for the SRCs and startup of all equipment and systems. The CA shall schedule functional tests through the CM, GC and affected Subs. The CA shall direct, witness and document the FT's of all equipment and systems. The Subs shall execute the tests.
2. In general, functional testing is conducted after completion of the start-up plan. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

H. Deficiencies, Non-Conformance, and Approval in Checklists and Startup:

1. The Subcontractors shall clearly list any items of the start-up and functional procedures not successfully completed at the bottom of the form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

2. The CA reviews and verifies all functional checklists and start-up reports and recommends approval to the PM. The CA assists the Subcontractors and vendors to correct and retest deficiencies or uncompleted items, involving other members of the commissioning team as necessary.

3.4 DEFICIENCY RESOLUTION

A. Documentation

1. The CA shall witness and document the results of all FT's using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC for review and approval and to the Subs for review.

B. Non-Conformance.

1. The CA shall record the results of the FT on the procedure or test form. All deficiencies shall be noted and reported to the GC and CM on a standard non-compliance form.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. The CA does not have the authority to overlook deficient work or loosen acceptance criteria to satisfy scheduling or cost issues.

4. If commissioning for equipment or systems is delayed by Owner occupancy requirements or other unforeseen conditions, the CA will coordinate completion with Owner's schedule. This may involve testing conducted outside of normal occupancy hours. Contractor assistance will still be required to conduct functional testing outside of normal occupancy hours without any additional cost to the owner.

5. If a deficiency is identified, the CA shall discuss the issue with the executing contractor.

a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

1) The CA documents the deficiency, records the Sub's response, and proceeds with remaining FT's. The Sub corrects the deficiency and certifies that the equipment is ready to be retested and coordinates retesting with the GC and CA.

2) The CA reschedules the test and the test is repeated.

b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

1) The deficiency shall be documented with the Sub's response and a copy given to the GC and to the Sub representative assumed to be responsible.

2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.

3) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency and certifies the equipment is ready for retesting. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

6. Cost of Retesting

a. The cost for the Sub to retest a functional test, if they are responsible for the deficiency, shall be borne by the Sub. If the Sub is not responsible, any cost recovery for retesting costs shall be negotiated with the GC.

b. The time for the CA and CM to direct any retesting required because a specific SRC, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the GC, who may choose to recover costs from the party responsible for executing the faulty SRC.

7. The Contractor shall respond in writing to the CA and CM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

8. The CA retains the original non-conformance forms until the end of the project.

C. Failure Due to Manufacturer Defect

1. If 10% of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the contract documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM or PM. In such case, the Contractor shall provide the Owner with the following:

    a. Within one week of notification from the CM or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM or PM within two weeks of the original notice.

    b. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

    c. The CM or PM will determine whether a replacement of all identical units or a repair is acceptable.

    d. One example of the proposed repair solution will be installed by the Contractor and the CM will be allowed to test the installations for up to one week, upon which the CM or PM will decide whether to accept the solution.

    e. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval

1. The CA notes each satisfactorily demonstrated function on the test form. The CA recommends acceptance of each test to the Owner. The Owner gives final approval for acceptance.

3.5 OPERATIONS AND MAINTENANCE DOCUMENTATION

A. The contractor will provide the owner with complete operations and maintenance information. Contractor to provide at a minimum:

1. Basic operation (i.e. narratives of basic equipment operation, interfaces, interlocks, and interaction with other equipment & systems, initial maintenance provided by the contractor).
2. General site operating schedules (i.e. instructions for changes in major system operating schedules, instructions for changes in major system holiday and weekend schedules).
3. Basic troubleshooting (i.e. cite recommended troubleshooting procedures specific to major systems and equipment, manual operation procedures, standby/backup/bypass operation procedures, major system power fail resets and restarts, trend log listing).
4. Recommended maintenance events log (i.e. HVAC air filter replacement schedule and log, building control system sensor calibration schedule and log).

B. Electronic O&M manuals shall be provided for all commissioned systems. Electronic O&M manuals shall consist of all hard-copy O&M manual data in searchable pdf files in a logical folder structure with descriptive file names which make it clear what the manual includes. In all cases, this requires renaming the files from any O&M's cryptic numeric file names.

C. Where electronic data from the manufacturer contains data about other models and features not included in this project, the contractor shall mark the applicable model and features for the equipment in this job in the pdf, so the operations staff can readily identify what equipment model and features in the electronic O&M apply to this building.

3.6 TRAINING OF OWNER PERSONNEL

A. Coordination: The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. A program for training of the appropriate maintenance staff for each equipment type and/or system shall be developed and documented in the commissioning report.

C. In addition to these general requirements, the specific training requirements of Owner personnel by Subs and vendors is specified in Division 21, 23 and 26 . Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:

1. System/equipment overview
2. Intended audience
3. Location of training

4. Objectives
5. Subject covered
6. Duration of training on each subject
7. Instructor for each subject
8. Instructor qualifications
9. Methods (lecture, video, site walk-through, written handouts, etc)
10. Review and demonstration of servicing/preventative maintenance
11. Review of record drawings on the system/equipment

D. For the primary HVAC equipment, the controls contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

E. Training shall cover a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover, as applicable, and any emergency procedures.

F. The trainings will be tailored to the needs and skill-level of the trainees and be oriented to the specific system installed in this project.

G. The contractor shall record the training sessions and provide the owner with a training manual and edited DVD of the training sessions.

3.7 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM.

B. Additional, missing or incomplete functional testing will be done by CA and will back charge to the responsible party. GC is responsible for collecting these charges and expenses from subcontractors.

3.8 FINAL REPORT

A. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. Outstanding non-compliance items shall be specifically listed.

END OF SECTION 01 91 00

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 220800 Plumbing Systems Commissioning.
2. Section 230800 HVAC Systems Commissioning.

3. Section 260800 Electrical 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 section 1.04 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, 23 05 00, and 23 05 93 for 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.
2. Section 02 20 00 Site Preparation
3. Section 02 30 00 Earthwork.
4. Section 02 41 19 Minor Demolition for Remodel

1.2 Quality Assurance

A. A Lab of Record will be retained by the Owner to observe 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

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of designated building equipment and fixtures.
B. Removal of designated existing construction.
C. Cap and identify utilities.
D. Temporary partitions to allow building occupancy.
E. Schedule of materials and equipment.
F. Temporary fire protection.
G. Coordination with hazardous waste removal.SUBMITTALS
H. Submit pre-demolition photographs showing conditions of all items to remain that might be misconstrued as damaged by demolition operations. Submit before Work begins.

1.2 QUALITY ASSURANCE

A. 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

B. Submit record drawings under provisions of Section 01 70 00.

C. 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 - 2019 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.

PART 2 - PRODUCTS

NOT USED

PART 3 - 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 as specified in Section 01 11 00.

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 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. Coordinate the work of this Section with related trades.

C. Verify applicable dimensions, clearances and heights at the jobsite.

D. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified herein and as necessary to complete the work required by project conditions, including but not limited to:

1. Cast-In-Place Concrete:
    a. Concrete Slab-on-Grade and all other floor slabs
    b. Concrete Footings and Foundations
    c. Below slab Vapor Barrier & Vapor Barrier Stakes
    d. Concrete Adhesives, Anchoring Cement, Non-Shrink Grout and Bonding Materials
    e. Concrete Admixtures
    f. Equipment Pads
    g. Vehicular Concrete Paving
    h. Concrete Retaining Walls
    i. Concrete Stairs and Ramps
    j. Concrete Seat walls
    k. Bollards (at building interior)
2. Concrete Curing
3. Integrally Colored Concrete
    a. Concrete Colorants
4. Accessories:
    a. Joint treatment
    b. Form Release
    c. Topical Sealers
    d. Slab and Foundation Edge Insulation
    e. High Density Rigid Foam fill
5. Concrete Floor Flatness testing

1.2 REFERENCE STANDARDS

A. 2022 California Code of Regulations (CCR), Title 24, California Building Standards Commission (CBSC) www.bsc.ca.gov current edition at time of permit issuance.

B. (CCR) Title 24, (CBSC) Chapter 11 – California Green Building Standards Code

1. Non-residential new construction
    a. All occupancy types

C. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines, current version.

D. ACI - American Concrete Institute (latest edition unless otherwise noted)

1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials
2. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete
3. ACI 301 Specifications for Structural Concrete
4. ACI 302 Guide to Concrete Floor and Slab Construction
5. ACI 305R Guide to Hot Weather Concreting
6. ACI 306R Guide to Cold Weather Concreting
7. ACI 318 Building Code Requirements for Structural Concrete and Commentary
8. ACI 360 Guide to Design of Slabs-on-Grade

E. ASTM - American Society for Testing and Materials (latest edition unless otherwise noted)

1. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C33 Standard Specification for Concrete Aggregates
3. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5. ASTM C94 Specification for Ready-Mixed Concrete
6. ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
7. ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
8. ASTM C150 Standard Specification for Portland Cement
9. ASTM C172 Standard Practice for Sampling Freshly-Mixed Concrete
10. ASTM C192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
11. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
12. ASTM C330 Standard Specification for Lightweight Aggregates for Structural Concrete.
13. ASTM C494 Standard Specification for Chemical Admixtures for Concrete
14. ASTM C618 Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
15. ASTM C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
16. ASTM C1157 Standard Performance Specification for Hydraulic Cement
17. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
18. ASTM E1155 Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers

F. Allen Face & Company, Inc. (910) 793-2877 www.allenface.com

1. The F-number & Concrete Floor Flatness/Levelness Resources

1.3 PERFORMANCE, TESTING AND INSPECTION

A. **General**:

1. Comply with manufacturer's standards.
2. Comply with Building Code.
3. Job site inspections shall be done as herein specified and as listed in drawings.
4. Testing shall be done as herein specified and as listed in drawings.

5. Refer to Division 1 for additional requirements for DSA projects

B. **Sustainability**:

1. Refer to Division 1 sustainability requirements.
2. Refer to product criteria identified herein.

C. **Testing & Inspections**:

1. General:

   a. Refer to Division 1 for Testing Laboratory service requirements.
   b. Cost of testing or re-testing shall be borne by **General Contractor**.

2. Structural Testing / Inspection:

   a. A testing program is required prior to start of construction. Testing program to be done in compliance with CBC Chapter 17A and CBC Chapter 19A requirements, and in collaboration with **Testing Laboratory**, **Architect**, **Structural Engineer**, **General Contractor**, and **Owner**. Testing program shall be submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in the final testing program.
   b. The following Concrete tests and inspections shall be made by a recognized testing laboratory selected by the **Owner** and approved by the governing agency. All tests shall be in accordance with the previously mentioned standards and ACI 318 Section 5.6. A complete record of all tests and inspections shall be kept per CBC Section 1903.1 1903A.1.

      1. Batch Plant:

         a. Provide Batch Plant Inspections per ASTM C685 and CBC Section 1704 1704A.

      2. Slump:

         a. Concrete consistency (slump) shall be tested in accordance with ASTM C143.

      3. Compressive Strength:

         a. Perform work in accordance with ASTM C39 and CBC Chapter 19A.

            1. Make and cure test specimens in accordance with ASTM C31. Test in accordance with ASTM C39 and ACI 318 Section 5.6.
            2. A complete record shall be made of all tests and inspections, including time and locations of tests; refer to CBC and ACI 318, Section 5.6.2.
            3. Four identical cylinders shall be taken from each pour of 150 cubic yards or 5000 square feet or part thereof, being placed each day per ACI 318 Section 5.6.2. One cylinder shall be tested at age 7 days, and two at age 28 days unless otherwise specified. Preserve remaining cylinder for future use as directed by **Architect**, **Structural Engineer**, and **Owner**.

   c. Provide full time inspection per CBC 1704A.3 during the taking of test specimens and during the placing of all concrete and embedded steel.
   d. Refer to Section 03 21 00 – Concrete Reinforcing for reinforcing steel tests and inspections.

3. Concrete Slab Moisture and Alkalinity Testing:

   a. Refer to Section 07 28 00 – Concrete Slab Vapor Emission Control Treatment for concrete slab vapor emission, PH, and relative humidity testing requirements.

4. Concrete Flatness and Levelness Testing:

   a. Standards:
      1. ASTM E1155
      2. FACE Standards

   b. Overall Flatness and Levelness Values:

      1. Office: FF 27 / FL 18, typical u.o.n.

         a. Not to exceed 1/8" per 10'-0" - non cumulative measured from 10'-0" at opposite ends over a 20'-0" length such that the measurable difference at the middle is 1/8" max.
         b. Polished concrete: FF50, 35 minimum

      2. Warehouse: FF 50 / FL 30

   c. Local Flatness and Levelness Values:

      1. Office: FF 17 / FL 13, typical u.o.n.

         a. Polished concrete: FL50, 35 minimum

      2. Warehouse: FF 30 / FL 21

   d. Testing:

      1. Test floor flatness and levelness between 48 and 72 hours after concrete slab pour.
      2. Test floor flatness and levelness between 48 and 72 hours prior to installation of floor finish to insure values are within each flooring manufacturers requirements.
      3. Test in accordance with the latest edition of ASTM E1155.

   e. Defective Concrete:

      1. Concrete not in compliance with the standards set forth in ACI 117 may be deemed defective.
      2. Defective concrete shall be remediated in accordance with PART 3 of this specification section.

1.4 SUBMITTALS AND MOCK-UPS

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

B. Submit O&M (Operation and Maintenance) manuals in accordance with Division 1 requirements and as herein specified.

C. Refer to Division 1 for sustainability requirements

D. Submittals:

   1. Concrete Mix Designs

      a. Submit Concrete Mix Designs, stamped by a licensed Civil Engineer, for review and approval; include test data used to establish proportions.

   2. Certificates:

      a. Submit Certificates of Compliance from Manufacturer for Cement, Aggregates and Admixtures.

   3. Product Data Sheets & MSDS Sheets:

a. Vapor Barrier & Vapor Stakes; include independent laboratory test results showing compliance with ASTM and ACI standards
b. Curing Blankets
c. Topical Curing Agents
d. Concrete Adhesives, Anchoring Cement, Non-Shrink Grout and Bonding Materials, etc.
e. Integral Concrete Colorant
f. Joint Treatment
g. Form Release
h. Topical Sealers
i. Hardeners
j. Slab Edge and Foundation Edge Insulation
k. High Density Rigid Foam Fill

4. Manufacturer's Installation Instructions:

a. Vapor Barrier and Stakes
b. Curing method & products

5. Samples:

a. Concrete Color samples
b. Grout samples for sacked surface textures and colors

6. Shop Drawings:

a. Provide joint layout plan & elevations showing all proposed construction and expansion joints for **Architect's** and **Structural Engineer's** review before construction. Highlight those items which deviate from drawings and those which are added or deleted items.

7. Test Results:

a. Floor Flatness (FF) and Floor Levelness (FL)

8. Transit Mix Delivery Slips:

a. Keep record at the job site showing time and place of each pour of concrete, together with transit-mix delivery slips certifying contents of the pour.
b. Make the record available to the **Architect** and **Owner** for their inspection upon request.
c. Upon completion of this portion of the work, deliver the record and the delivery slips to the **Architect** and **Owner**.

E. Mock-ups:

1. Mock-up shall be one each of the following with final specified curing, admixtures, sealers, etc.:

a. Seat walls: 8'-0" minimum length

1. Sandblast texturing per Section 04 01 80 – Masonry Shot & Sandblasting
2. Sack and Patch finish
3. Mock-ups may be a part of final construction. Mock-up must be accepted by **Architect** prior to the start of final construction; reviewed and accepted mock-ups shall serve as standard for subsequent Work

b. Slab-on-grade: 8'-0" x 8'-0"

1. Mock-ups shall not be a part of final construction; after completion of building slabs, demolish and remove mock-up. Mock-up must be accepted by **Architect** prior to the start

of final construction; reviewed and accepted mock-ups shall serve as standard for subsequent Work

c. Vehicular paving: 8′-0″ x 8′-0″

1. Mock-ups shall not be a part of final construction; after completion of building slabs, demolish and remove mock-up. Mock-up must be accepted by **Architect** prior to the start of final construction; reviewed and accepted mock-ups shall serve as standard for subsequent Work

2. Construction:

a. Cast mock-ups at job site from approved materials identical to those to be used on site.
b. Shall include expansion, construction joints, with, hardeners, sealers, sealants, chamfers, etc. and finish as specified and detailed.

3. **Architect** will review and accept mock-up when it is determined that the mock-up represents the design intent.

a. Mock-up must be accepted by **Architect** prior to the start of final construction; reviewed and accepted mock-ups shall serve as standard for subsequent Work.

1.5 QUALITY ASSURANCE

A. Refer to Division 1 for quality control requirements.

B. Contractor shall have been in business for five (5) years providing/finishing similar size projects and complexity.

C. Manufacturer(s) shall have been in business for five (5) years providing/finishing similar size projects and complexity.

D. Stipulations:

1. Concrete shall not be placed unless batch records are in compliance with accepted structural values.
2. Reporting shall be completed and tracked for all testing in accordance with CBC 1704A.1.1

E. Concrete shall be installed and finished by persons regularly engaged in this type of work.

1. Provide the services of a qualified and experienced superintendent who shall be hands-on and constantly be in charge of the work of this section and who shall remain at the site at all times that work is in progress. This superintendent shall direct all work performed under this Section.
2. Provide persons at all times during execution of this portion of the work who are thoroughly familiar with the type of materials being installed and the best methods for their installation. All workmen shall have five (5) years of experience installing and finishing concrete and hardened Concrete.

F. Preconstruction meeting:

1. Give 7 days' NOTICE before start of any Work under this Section.
2. Arrange for pre-construction meeting at the project site.

a. **General Contractor** and installing Subcontractor (Site superintendent and Area Superintendent) shall attend.
b. **Architect** and **Structural Engineer** shall be asked to attend.
c. **General Contractor** shall organize and record the proceedings at the meeting.

G. **Architect** shall be notified two days prior to each concrete pour to allow review of vapor barrier installation.

1. Manufacturer's Representative:

a. Make arrangements necessary to have a trained employee of the manufacturer on-site periodically during installation of Vapor Barrier work to review installation procedures.
b. Manufacturer's representative shall review and certify installation of vapor barrier to verify the complete work meets specification requirements.

H. **Architect** and **Structural Engineer** shall be notified 48 hours prior to each concrete pour to allow Structural Engineer to review concrete reinforcement.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 for product delivery, storage and handling requirements.

1.7 JOB CONDITIONS

A. Field-verify that all components, backing, forms, subgrade, etc. by others are installed correctly to proceed with installation of products as herein specified.

B. Protect finish surfaces at all times from concrete adjacent to them.

1. Inspect forming against such work and establish tight leak proof seal before concrete is placed within or against the forming.
2. Protect other surfaces from concrete.
3. Finish work defaced with concrete on surface shall be replaced.

a. Concrete to be left exposed: Do not place materials on concrete, which might leave a pattern and/or imprint.
b. Protect concrete from damage by other trades.

1.8 GUARANTEE / WARRANTY

A. Refer to Division 1 for closeout submittal procedures.

B. Furnish **one (1)** year written warranty signed by manufacturer and installer agreeing to repair and/or replace work which has failed as a result of defects in materials or workmanship.

1. Upon notification of **Owner** within the warranty period, such defects shall be repaired and replaced at no cost to the **Owner**.

1.9 RELATED WORK/SECTIONS

A. Related work includes, but is not limited to, the following:
1. Grading
2. Subgrade and Building Pad preparation
3. Utility installation and coordination with footings and slab penetrations
4. Coordinate structural concrete, pads, and supported slabs and floors with site drainage, and

a. mechanical, electrical and plumbing work.

B. Related Sections include, but are not limited to, the following:

1. Division 1

2. Section 02 41 13 – Selective Site Demolition & Protection
3. Section 02 41 19 – Selective Building Demolition & Protection
4. Section 05 50 00 – Metal Fabrications
5. Section 05 52 00 – Metal Railings
6. Section 05 55 00 – Metal Stair Treads & Nosing
7. Section 32 13 13 – Portland Cement Concrete Paving
8. Section 33 10 00 – Water Utilities
9. Section 32 33 00 – Site Furnishings
10. Section 32 17 26 – Tactile Warning Surfacing

1.10 SEQUENCING AND SCHEDULING

A. **General Contractor** shall schedule and sequence work with related trades.

B. Schedule required testing, prior to the installation of materials, components, etc.

PART 2 - **PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

A. Single source responsibility, specified items shall be from one manufacturer for each product type.

B. Acceptable manufacturers shall be one of the following and as herein listed and in Drawings:

1. Refer to documents and as herein specified
2. Reviewed Equivalent by **Architect**.

a. Substitutions and deviations shall require **Architect's** approval and shall be given in letterform.
b. Refer to Division 1 for substitution, deviation and/or submittal procedures.
c. Proposed alternate products must be equal in terms of chemical composition, color, finish, configuration, performance standards, etc.

C. All products and materials indicated shall be installed according to current listed specification requirements and manufacturers specifications/recommendations.

D. Refer to drawings, details, and other related specification section whether listed or not.

E. Details shall set basic requirements for size and configuration of systems.

2.2 MATERIALS: CONCRETE

A. Grade: Subgrade shall be graded, compacted, etc. in compliance with drawings and specifications.

B. Gravel Base:

1. Hard, durable, clean sand gravel, or crushed stone, free from organic material, clay balls, ASR aggregate or other deleterious substance installed over compacted grade, typical all conditions except warehouse.

C. Aggregate Base:

1. Hard, durable, clean Caltrans Class II aggregate base free from organic material, clay balls or other deleterious materials installed over compacted grade, typical at warehouse.

D. Portland Cement: ASTM C150, Type II or Type V. One brand of cement shall be used throughout to maintain uniform color for all exposed concrete.

E. Aggregates: Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of appropriate ASTM Standards and building code including as herein specified.

1. Concrete aggregates for Standard Weight Concrete shall meet ASTM C33 and be crushed granite or Perkins type.
2. Concrete aggregates for Lightweight Concrete shall meet ASTM C330 to produce concrete weighting no more than 115 pcf at 28 days. Aggregate shall be vacuum saturated expanded shale as produced through the rotary kiln method.

F. Water: Clean and free from injurious amounts of oil, acid, alkalis, salt, scale, organic materials and other deleterious substances; suitable for domestic consumption.

G. Admixtures: Admixtures shall be subject to prior approval by the **Architect** and **Structural Engineer** in accordance with ACI 318 Section 3.6. Calcium Chloride is not permitted.

1. Water Reducing:
    a. ASTM C494: Type A for use in cool weather
        1. BASF Master Pozzolith or equivalent
    b. ASTM C494: Type D for use in hot weather
        1. BASF Master Pozzolith or equivalent
2. Air Entraining:
    a. ASTM C260
        1. BASF Master Air or equivalent
3. Fly Ash Pozzolan:
    a. ASTM C618 – Class F
    b. Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete
    c. Applicable only where allowed for use in concrete mix design; not to exceed 15% unless otherwise approved by **Architect** and **Structural Engineer**.
4. Mid-Range Water Reducing Admixtures
    a. ASTM C494
        1. BASF Master Polyheed or approved equal
5. Plasticizer:
    a. Applicable only where allowed for use in concrete mix design; not to exceed 15% unless otherwise approved by **Architect** and **Structural Engineer**.
    b. W.R. Grace ADVA 100 or equivalent

H. Integral Colorant:

1. Concentrated pigments specially processed for mixing into concrete and complying with ASTM C979. Colorants containing carbon black are not acceptable.
2. Product: Davis Colors, Mix-Ready
3. Mix Ratio: As required by Manufacturer to achieve specified color.
4. Color Number: --- **Color to be approved by Architect**
5. Color Name: --- **Color to be approved by Architect**

1. Accessories:
    a. All accessories shall be provided by Vapor Barrier Manufacturer, including but not limited to: termination bars, adhesive seam tape, mastic, patching compound and pipe boots.

I. Vapor Barrier Stakes

1. Mfgr: Vaporstake, LLC
2. Product: Vapor Stake
    1. Non-corrosive, leak-resistant PVC plastic stake which acts as a permanent plug in the vapor retarder. Stake is pre-pointed with pre-drilled holes for 16d duplex nails.
3. Lengths: available in 30", 36" and 48" lengths

2.3 MATERIALS: CONCRETE MIX DESIGNS

A. **Type "A" Concrete:**

1.	Application:	For use at footings, foundations, curbs not integral with slab-on-grade, and fire riser thrust blocks. At General Contractor's option, Type "B" concrete may be substituted for this.
2.	Strength:	3000 psi @ 28 days
3.	Aggregate size:	1-1/2" max.
4.	Cement:	6.0 sacks per cubic yard min
5.	Water/cement ratio:	0.55 max.
6.	Slump:	3-1/2" [+/-1/2"]
7.	Admixture:	Water Reducing
8.	Fly Ash:	15% maximum content as a percentage of total cementitious material
9.	Air Entrainment:	1.5% max.

B. **Type "A1" Concrete:**

1.	Application:	Lean Mix fill for footings.
2.	Strength:	1500 psi @ 28 days
3.	Aggregate size:	1" max.
4.	Cement:	3.0 sacks per cubic yard min
5.	Water/cement ratio:	1.06 max.
6.	Slump:	4" [+/-1/2"]
7.	Admixture:	Water Reducing
8.	Fly Ash:	None
9.	Air Entrainment:	1.5% max.

C. **Type "B" Concrete:**

1.	Application:	For use at slab-on-grade.
2.	Strength:	4000 psi @ 28 days
3.	Aggregate size:	1" max.
4.	Cement:	7.0 sacks per cubic yard min
5.	Water/cement ratio:	0.38 max.
6.	Slump:	4" maximum
7.	Admixture:	Water Reducing
8.	Fly Ash:	15% maximum content as a percentage of total cementitious material

9. Air Entrainment: 1.5% max.

D. **Type "B1" Concrete:**

1. Application: For use at site seat walls.
2. Strength: 4000 psi @ 28 days
3. Aggregate size: 1″ max.
4. Cement: 7.0 sacks per cubic yard min
5. Water/cement ratio: 0.38 max.
6. Slump: 4″ maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 3% min.

E. **Type "C" Concrete:**

1. Application: For use at columns, beams, building walls and overhead structural slabs, u.o.n.
2. Strength: 4000 psi @ 28 days
3. Aggregate size: 1″ max.
4. Cement: 6.5 sacks per cubic yard min
5. Water/cement ratio: 0.5 max.
6. Slump: 4″ maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 1.5% max.

F. **Type "D" Concrete:**

1. Application: For use at normal weight concrete over metal deck.
2. Strength: 3500 psi @ 28 days
3. Aggregate size: 3/4″ max.
4. Cement: 6.0 sacks per cubic yard min
5. Water/cement ratio: 0.50 max.
6. Slump: 3-1/2″ maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 1.5% max.

G. **Type "E" Concrete:**

1. Application: For use at interior lightweight concrete over metal deck.
2. Strength: 3000 psi @ 28 days
3. Aggregate size: 3/4″ max.
4. Cement: 6.0 sacks per cubic yard min
5. Water/cement ratio: 0.50 max.
6. Slump: 3-1/2″ maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 1.5% max.

H. **Type "F" Concrete:**

1. Application: For use at interior concrete filled metal pan stairs

2. Strength: 4000 psi @ 28 days
3. Aggregate size: 3/8" max.
4. Cement: 8.0 sacks per cubic yard min
5. Water/cement ratio: 0.42 max.
6. Slump: 4" maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 1.5% max.

I. **Type "F1" Concrete:**

1. Application: For use at exterior concrete filled metal pan stairs
2. Strength: 4000 psi @ 28 days
3. Aggregate size: 3/8" max.
4. Cement: 8.0 sacks per cubic yard min
5. Water/cement ratio: 0.42 max.
6. Slump: 4" maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 3% min.
10.

J. **Type "G" Concrete:**

1. Application: For use at site retaining walls & loading dock walls.
2. Strength: 4000 psi @ 28 days
3. Aggregate size: 3/8" max.
4. Cement: 5.5 sacks per cubic yard min
5. Water/cement ratio: 0.41 max.
6. Slump: 4" maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 3% min.

K. **Type "H" Concrete:**

1. Application: For use at site concrete stairs and ramps
2. Strength: 3000 psi @ 28 days
3. Aggregate size: 3/8" max.
4. Cement: 5.5 sacks per cubic yard min
5. Water/cement ratio: 0.48 max.
6. Slump: 4" maximum
7. Admixture: Water Reducing
8. Fly Ash: 15% maximum content as a percentage of total cementitious material
9. Air Entrainment: 3% min.

L. **Type "J" Concrete:** (confirm design with Civil engineer and Geotechnical report)

a. Application:

1. Vehicular Paving
2. Equipment Pads

b. Strength: 4000 psi @ 28 days

c. Slump: 3-1/2″ [+/-1/2″]
d. Cement: 6.7 sacks per cubic yard
e. Water/cement ratio: 0.45 max.
f. Aggregate size: 1″ max.
g. Water: Potable water
h. Air Entrainment: 3% min.
i. Design: 6″ PCC min. over Aggregate Base; refer to Civil and/or Structural Drawings
j. Colorant:
   1. Where indicated on Drawings
   2. Product as herein specified
   3. Mix in accordance with colorant manufacturer's recommendations

M. For other non-structural site concrete mix designs not identified herein, refer to Section 32 13 13.

N. Concrete mix.

1. Initial mix design shall be prepared for all concrete in accordance with ACI 318 Section 5.2. Mix proportions shall be determined in accordance with ASI 318 Section 5.3 or Section 5.4. In the event that additional mix designs are required due to depletion of aggregate sources, aggregate not conforming to Specifications or at request of **General Contractor**, these mixes shall be prepared as above.

   a. Typical: CBC Section 1905 including but not limited to; Section 1905.2, 1905.3, 1905.4 & 1905.8.
   b. DSA: CBC Section1905A including but not limited to; 1905A.2, 1905A.3, 1905A.4 & 1905A.8

2. **General Contractor** shall notify the Testing Laboratory and **Architect** of intent to use concrete pumps to place concrete so that mix designs can be modified accordingly.
3. Fly ash shall not exceed the percentages of the total cementitious material listed in the Concrete Mixes above.
4. Owner's testing laboratory shall review all mix designs.
5. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required to provide a workable consistency for pump mixers.
6. **Addition of water shall not be allowed during mixing and/or during placement of concrete.**

2.4 MATERIALS: CONCRETE CURING

A. General

1. Evaporation Control

   a. Application:

      1. Proceed in accordance with standards to insure temperature is used in factoring in how and when slab is placed.
      2. Install barricades to block wind.

B. Concrete Slab-on-Grade Curing:

1. Wet Curing Blankets: Typical all concrete slab-on-grade, except warehouse slabs central plant slabs polished concrete and stained concrete.

   a. Option 1: Raven Industries ConKure80

      1. Type: White Reflective Wet Curing Blanket

2. Standards: AASHTO M-171, ASTM C171
3. Properties:

a.	Weight:	36lbs/1000ft^2, ASTM D751
b.	Thickness:	21 mil, ASTM D5199
c.	Grab Tensile Strength:	92lbf, ASTM D5034
d.	Grab Tensile Elongation:	60%, ASTM D503
e.	Trapezoid Tear:	36lbf, ASTM D4533
f.	Puncture:	56lbf, ASTM D4833
g.	Impact Resistance:	610g, ASTM D1709 (B)
h.	Mullen Burst:	126 psi, ASTM D3786
i.	Elmendorf Tear:	3075g, ASTM D1922
j.	Light Reflectance:	94%, ASTM E1347 per ASTM C11-05
k.	Water Loss (WVTR):	0.005oz/ft^2/24hrs, ASTM E96 per ASTM C171-05

b. Option 2: Reef Industries, Armorlon Transguard 2000

1. Type: White Reflective Wet Curing Blanket
2. Standards: ASTM C171
3. Properties:

a.	Weight:	42lbs/1000ft^2, ASTM D2103
b.	Thickness:	35 mil, ASTM D5199
c.	Grab Tensile Strength:	95lbf, ASTM D4632
d.	Grab Tensile Elongation:	50%, ASTM D4632
e.	Trapezoid Tear:	34lbf, ASTM D4533
f.	Puncture Strength:	65lbf, D4833
g.	Hydraulic Burst:	190 PSI, ASTM D3786
h.	Light Reflectance:	85%, ASTM E1347
i.	Water Loss (WVTR):	0.0016oz/ft^2/24hrs, ASTM C156

2. Wet cure as herein specified in PART 3 and per Manufacturer's recommendations.

C. Exterior Stair & Ramp Concrete Curing:

1. Manufacturer: W.R. Meadows
2. Products: 1100 – Clear series
3. Material: Water based acrylic curing and sealing compound
4. Preparation: Per manufacturer's recommendations
5. Application: Per manufacturer's recommendations
6. VOC: 113g/l
7. Standards: AASHTO M148 Type 1 Class A&B, ASTM C309

D. Exterior Vehicular Concrete Curing / Sealer / Top Coat:

1. Manufacturer: L&M Construction Chemicals, Inc.
2. Penetrating Sealer: Petrotex

a.	System:	Water based solution containing silane, siloxane & fluoropolmers
b.	Preparation:	Clean substrate with a non-acid cleaner
c.	Application:	Per manufacturer's recommendations
d.	Limitations:	Install minimum 28 days after concrete has been placed
e.	VOC:	<250 g/l

3. Protective Top Coat: Lumiseal FX

   a. System: Water based, non-yellowing, blush resistant curing and sealing compound
   b. Application: Two coats, minimum at 2 to 3 hours apart
   c. VOC: <100 g/l

2.5 MATERIALS – GROUT, ADHESIVES AND STRUCTURAL COMPONETS

A. Joint Filler:

1. Joint fill shall be a preformed non-extruded resilient filler, saturated with bituminous materials and conforming to ASTM D1751. Products shall be equivalent to Burke "Fiber Expansion Joint", W.R. Meadows "Fibrated Expansion Joint Filler", or approved equal.

B. Non-Shrink Grout: (Non-metallic, no chlorides, no aluminum powder)

1. Application: Provide non-shrink grout conditions including, but not limited to, anchor bolts, reinforcing dowels and rods, machinery bases, precast columns, grouting of structural and non-structural building members, tilt-up wall panel grouting, and as noted on structural drawings.
2. Manufacturer & Product:

   a. BASF, Master Builders, MasterFlow 713 or 928
   b. US SPEC, Premium Grout
   c. L & M Construction Chemicals, Inc., Crystex Grout

3. Installation: Install per manufacturer's recommendations

C. Anchoring Cement:

1. Application: Typical all conditions as noted on structural drawings
2. Manufacturer & Product:

   a. BASF, Master Builders, MasterFlow 110AN
   b. US SPEC Products Co., Anchoring Cement

3. Limitations:
   a. Do not apply when temperature is below 40ºF, or due to fall below 40ºF within 48 hours.
   b. Do not apply over surfaces that are frozen or contain frost.

4. Installation: Install per manufacturer's recommendations

D. Structural Bonding Adhesive:

1. Application: Typical all conditions
2. Manufacturer & Product:

   a. US MIX Products Co. (303) 778-7227 Maxi-Bond 2500
   b. L & M Const. Chemicals, Inc. EPO Bond

3. Limitations: Per data sheet
4. Installation: Install per manufacturer's recommendations

E. Bonding Materials:

1. Application: Exterior

   a. Manufacturer & Product:

      1. US MIX Products Co. (303) 378-2034 Acrylcoat

2. L & M Const. Chemicals, Inc. L&M "EVERBOND"

b. Material: Acrylic latex bonding agent, non-re-emulsifiable type
c. Limitations: Per data sheet
d. Installation: Install per manufacturer's recommendations

2. Application: Interior

a. Manufacturer: & Product Options:
b. US MIX Products Co. (303) 378-2034 Bond Coat
c. L & M Const. Chemicals, Inc. L&M "EVERWELD"
d. Material: Polyvinyl Acetate
e. Limitations: Per data sheet
f. Installation: Install per manufacturer's recommendations

B. MATERIALS – MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Form Release:

1. Application: Bond breaking form release for concrete forms, equipment and tools
2. Manufacturer: L&M Construction Chemicals, Inc.
3. Product: Debond Form Coating
4. Material: Chemical form coating consisting of highly refined fatty acids extracted from pine tree (coniferous), carried in a non-staining, non-residual petroleum hydrocarbon.
5. Installation: Install per manufacturer's instructions
6. Limitations: Do not use for Tilt-Up Concrete construction; refer to Section 03 47 13 for form release specific to Tilt-Up Concrete work.

B. Tactile Components:

1. Provide and coordinate installation of Detectable Warning Components per Section 32 17 26 - Tactile Warning Surfacing and drawings.

C. Stair Nosing:

1. Provide and coordinate installation of Metal Stair Treads and Nosings per Section 05 55 00 - Metal Stair Treads and Nosings.

D. Skate Deterrents:

1. Provide skate deterrents at seat walls; refer to Section 32 33 00 – Site Furnishings.

E. Leveling Compounds, Patching Mortar, and Resurface Coatings

1. Provide leveling compounds, patching mortars and resurface coatings per Section 03 00 61 - Concrete Floor Leveling, Patching & Grouting – Cementitious

F. Concrete Cleaners:

1. Provide Concrete Cleaners and perform work per Section 03 00 51 – Concrete Cleaning.

G. Vapor Emission Control Treatment:

1. Provide concrete slab vapor emission/alkalinity control/relative humidity treatment per Section 07 26 00 – Concrete Slab Vapor Emission Control Treatment.

H. Abrasive Aggregate for non-slip finish:

1. Fused aluminum oxide grits, graded 12/30. Use factory-graded rustporoof and non-glazing material that is unaffected by freezing, moisture and cleaning materials.
    a. Products offered by manufacturers to comply with the above requirments such as Anti-Hydro Waterproofing Company's "A-H Alox" or equal.

I. Other Materials:

1. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the **General Contractor** subject to the approval of the **Architect**.

PART 3 - **EXECUTION**

3.1 INSPECTION / EXAMINATION

A. Verification of Conditions:

1. Prior to proceeding with the work, the Installer shall examine the existing conditions and substrate.
2. The Installer shall report any unsatisfactory conditions to the General Contractor and Architect immediately.
3. Do not proceed until unsuitable and/or unsatisfactory conditions have been corrected.
4. Proceeding with work means the Installer accepts the existing conditions and substrates, and any problems related to the existing conditions or substrate shall be repaired to the satisfaction of the **Architect**, without additional cost to the **Owner**.

3.2 COORDINATION

A. Refer to Section 01 31 13 – Project Coordination.

B. **General Contractor** shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.3 PREPARATION

A. Prepare work, substrates, etc. in accordance with manufacturer's recommendations.

3.4 INSTALLATION - GENERAL

A. Installation shall be in accordance with Building Code and ACI standards.

B. Perform work in accordance with manufacturer's recommendations, as herein specified and in accordance with drawings.

C. All interpretations and decisions shall be made by the **Architect** and **Inspector of Record** and shall be in accordance with design unless approved otherwise by **Structural Engineer**.

D. Mock-ups must be approved prior to start of construction.

3.5 INSTALLATION - FORMWORK

A. Concrete formwork shall be reviewed by **Structural Engineer**.

1. Notify **Architect** and **Structural Engineer** 48 hours in advance of each concrete pour.

B. Before placing concrete, forms shall have been erected, adequately braced, cleaned of all debris, sealed, lubricated (if required), and bulk headed where placing is to stop. Any wood forms other than plywood

shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.

C. Refer to Section 03 11 00 – Concrete Forming.

3.6 INSTALLATION - REINFORCEMENT

A. Reinforcement shall be reviewed by **Structural Engineer**.

1. Notify **Architect** and **Structural Engineer** 48 hours in advance of each concrete pour.

B. Place, tie and support reinforcing steel; refer to Section 03 20 00 – Concrete Reinforcing.

C. Clean reinforcing steel and other embedded items of mill scale and/or all coatings that would impair bond.

D. Before placing concrete, clean areas to be occupied by concrete of all wood ships, sawdust, dirt, debris, hardened concrete and other foreign matter. No wooden ties or blocking shall be left in the concrete except where indicated for attachment of other work.

3.7 SLAB EDGE and FOUNDATION EDGE INSULATION / FORMING **[Specifier – this section to be completed with project requiring this scope of work]**

3.8 INSTALLATION - MIXING OF CONCRETE

A. Equipment:

1. All concrete shall be machine mixed. Provide adequate equipment and facilities for accurate measurement and control of materials.

B. Method of Mixing:

1. Transit Mixing shall comply with ASTM C94. Ready mixed concrete shall be used throughout, except as specified below.
2. On-Site mixing shall be used only if method of storing material, mixing of material and type of mixing equipment is approved by the **Architect** and **Structural Engineer**. Approval of site mixing does not relieve **General Contractor** of any other requirements of the specifications.
3. Mixing shall be in accordance with ACI 318 Section 5.8.

C. Mixing time:

1. After mix water has been added, concrete shall be mixed not less than 1-1/2 minutes nor more than 1-1/2 hours. Concrete shall be rejected if not deposited within the time specified.
   a. Mix until there is uniform distribution of material and mass is uniform and homogeneous; mixer must have automatic devices for measuring water and timing mixing operations; capacity of mixer one or more full sack batches; split sack batches not permitted.

D. Admixtures:

1. Air entraining and chemical admixtures shall be charged into mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by manufacturer. Accuracy of measurement of any admixture shall be within plus or minus 3%.
2. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence, and provided further that admixtures used in that

combination retain full efficiency and have no deleterious effect on concrete or on properties of each other.

3. All admixtures are to be approved by **Structural Engineer**, Testing Lab and DSA prior to commencing with work.
4. Add Integral Concrete Colorant in accordance with colorant manufacturer's recommendations.

E. Retempering:

1. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall be discarded, not retempered.
2. Indiscriminate addition of water to increase slump is prohibited.

F. Cold Weather Batching:

1. When average of the highest and lowest air temperature falls below 40ºF for more than three consecutive days, provide adequate equipment for heating concrete materials. No frozen materials or materials containing ice shall be used. When placed in forms, concrete shall have a minimum temperature based on dimensions of concrete sections placed per ACI 301.

G. Hot Weather Batching:

1. Concrete deposited in hot weather shall have a placing temperature below 90°F per ACI 301. If necessary, ingredients shall be cooled to accomplish this.

3.10 INSTALLATION - PLACING OF CONCRETE

A. Transportation: Handle from mixer to place of final deposit by methods which will prevent separation or loss of ingredients; deposit as nearly as practicable in final position in a manner which will insure that required quality is obtained. Partially hardened concrete shall not be deposited in work. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.

B. Conveying: Handle concrete from mixer to place of final deposit by methods which will prevent separation or loss of ingredients. Deposit concrete in forms as nearly as practicable at its final position in a manner which will insure that required quality is obtained. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.

C. Placing / Depositing: Deposit concrete into forms in horizontal layers not exceeding 24 inches in thickness around building, proceeding along forms at a uniform rate and consolidating into previous pour. In no case shall concrete be poured into an accumulation of water ahead of pour, nor shall concrete be flowed along forms to its final place of deposit. Fresh concrete shall not be permitted to fall from a height greater than four (4) feet without use of adjustable length pipes or, in narrow walls, of adjustable flexible hose sleeves. Concrete shall be scheduled so that placing is a continuous operation for the completion of each section between predetermined construction joints. If any concreting operation, once planned, cannot be carried on in a continuous operation, concreting shall stop at temporary bulkheads, located where resulting construction joints will least impair the strength of the structure. Location of construction joints shall be as shown on the drawings or as approved by **Structural Engineer**. The rate of rise in walls shall not be less than 2 feet per hour.

1. Consolidation: Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing. Power vibrators of approved type shall be used immediately following pour. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by **Structural Engineer**. In no case shall vibrators be placed against reinforcing steel or used for extensive shifting of deposited fresh concrete. Provide and maintain standby vibrators, ready for immediate use.

2. Hot Weather Concreting: Unless otherwise directed by the **Architect** and **Structural Engineer**, perform all work in accordance with ACI 305 when air temperature rises above 75˚F and the following:
    a. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.
    b. Aggregate: Keep aggregate piles continuously moist by sprinkling with water.
    c. Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 90˚F per ACI 301. The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.
    d. Dampen subgrade and formwork before placing concrete. Remove all excess water before placing concrete. Keep concrete continuously wet when air temperature exceeds 85ºF for a minimum of 48 hours after placing concrete.
    e. Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection in place for 14 days minimum.
    f. Ambient Air placing temperature shall not exceed as herein specified.
3. Cold Weather Concreting: Follow recommended ACI 306 procedures when average of the highest and lowest air temperature falls below 40˚F for more than three consecutive days. Concrete placed in these temperatures shall have a minimum temperature based on dimensions of concrete sections placed as shown in ACI 301. No chemicals or salts shall be used to prevent freezing and no accelerative agents shall be used without prior approval from **Architect** and **Structural Engineer**.
4. Concrete with temperature exceeding limits herein specified at time of placement will be rejected and shall be removed from job.

D. Screeding:

1. Install all ground floor – slab on grade concrete with Laser Screed machinery or approved equal.
    a. Use floating form base (Floating Screed) which are integral to a flat steel plate to eliminate puncturing the vapor barrier.
2. Install all elevated slabs by placing primary screeds at edges of pour as approved by **Structural Engineer**. Intent is to provide a flat and level surface between the primary screeds. Secondary intermediate screeds may be installed as deemed necessary by **General Contractor** and approved by **Structural Engineer** for accurate placement. All secondary intermediate screeds shall be monitored and adjusted to accommodate structure deflection during placement to maintain flat and level surface. "Constant thickness" placement methods are not acceptable.

3.11 INSTALLATION – CONCRETE JOINTS

A. General:

1. Construction joints, including their location, shall comply with the provisions of ACI 318, Section 6.4, CBC Section 1906A.4, and requirements provided herein.
2. Saw cut joints in slab shall be cut at earliest time when slab can be walked on.
3. Install joints before slab is cured.
4. Proposed joint layout plan shall be submitted as part of Submittal process for review prior to installation of joints.

B. Construction Joints: Install only as indicated and noted on Drawings. Joint not indicated on Drawings shall be so located, when approved, as to least impair strength of structure, and shall conform to typical

details. Construction Joints shall have level tops, vertical sides. Horizontal construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean aggregate solidly embedded in mortar matrix. Joints between concrete and masonry shall be considered construction joints. Vertical construction joints need not be roughened. See Drawings for doweling and required keys.

1. Roughen construction joints by any of the following methods:
    a. By sandblasting joint.
    b. By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done no less than 3 hours nor more than 4 hours after concrete has been poured, depending upon setting time.
2. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall be reviewed with the **Structural Engineer**.
3. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened, but not saturated.
4. For slabs, construction joints shall be in locations shown on plan. If not shown, locate at intervals not exceeding 150 feet in each direction. Refer to drawings for proper details for reinforcing at construction joints.

C. Expansion Joints:

1. Unless otherwise indicated, use 3/8" thick expansion joint filler.
2. Joints in interior slab-on-grade conditions shall be only in locations indicated.
3. Joints in exterior slab-on-grade shall be installed at each side of structures, at curb transitions opposite apron joints, at ends of curb returns, at back of curb when adjacent to sidewalk, and at uniformly spaced intervals not exceeding 20 feet.
4. Edges of concrete at joints shall be edger finished to approximately 3/8" radius.
5. Interrupt reinforcing at all expansion joints.

D. Control Jointing - Concrete Slab-on-Grade:

1. Joints shall be in locations indicated on Drawings, or as directed by **Architect**.
2. Joints in interior slabs shall be made by one of the following methods:
    a. By use of construction joints laid out in checkerboard pattern; pour and allow alternate slabs to set; fill out balance of checkerboard pattern with second pour.
    b. By use of dummy groove joints at least 1/4 the depth of slab, and at least 1/8" wide. These joints may be sawcut as soon as wet concrete can support the weight of the equipment and operator. Delaying sawcutting past this point will make jointing ineffective.
3. Control jointing in exterior paving slabs shall be laid out in a checkerboard pattern; pour as described above but with joint edges tooled to provide a uniform joint at least 3/8" in depth.
4. Slab reinforcing need not be terminated at control joints
5. Construction and expansion joints shall be counted as control joints.

E. Score markings on exterior slabs on grade shall be located as indicated. Where not indicated, mark slabs into rectangles of not less than 12 square feet nor more than 20 square feet using a scoring tool which will leave edges of score markings rounded.

3.13 INSTALLATION - CONCRETE FINISHING AND PATCHING

A. Immediately after removal of forms and after concrete surfaces have been inspected:

1. Remove fins and rough spots
2. Remove forming ties.
3. Honeycombed areas shall be removed down to sound concrete, coated with a bonding grout or approved compound and patched using a low shrinkage high bond mortar.
4. Fill damaged and irregular surfaces, holes left by form clamps and tie wires, and sleeves with "Patching Mortar". Match texture of exposed adjacent concrete surface.
5. Patching not allowed on colored concrete.
6. Patching not allowed where structural strength is affected.
7. Patching of concrete is subject to approval by **Structural Engineer** and DSA.

B. Leveling: Floor leveling materials shall be applied as required to meet tolerance; gypsum base products are not allowed

C. Joints: Mark off exposed joints, where indicated, with 1/4 inch radius edging tool. Markings to be clean cut, straight, and square with respect to border. Tool edges of exposed expansion and contraction joints, border edges, and wherever concrete adjoins other material or vertical surfaces.

D. Sack Surfaces: Exposed surfaces that are unacceptable in appearance to the **Architect** shall be sacked upon **Architect's** approval.

1. Prepare concrete surfaces in accordance with the referenced standards. Remove any form release materials by stoning by hand, power grinding or other method approved by the **Architect**.
2. Prepare concrete surfaces to receive sack finishing with a light sand blasting.
3. Prepare grout samples for matching of concrete surfaces for approval by the **Architect**. These shall be made in the following proportions of gray cement to white cement to sand: 1:1:2, 1:2:3, and 2:1:3, etc. until the correct matching color is obtained on the test areas. Sand should be fine enough to pass the Number 30 sieve. Mixes should be made to a good workable consistency in a clean container. Provide sufficient qualities of sand and cement from the same source for the complete work at the job site.
4. Mixing and Application:

    a. Time mixing of grout on the job such that it will be used within 1 to 1-1/2 hours.
    b. Let the grout stand 20 to 30 minutes after mixing, and then re-mix before applying.
    c. Soak the concrete surface thoroughly with water at least 15 minutes before applying grout and again just before application so that the surface is adequately wet during the operation.
    d. Apply grout with plasterer's trowel or sponge rubber float in sweeping strokes from the bottom up. Brush or spray gun applications may be used when approved by the **Architect**.
    e. Work in freshly applied grout vigorously with a sponge rubber float, then let sit until some of its plasticity is gone but not until it loses its damp appearance. At this point it shall be rubbed with clean, dry burlap to remove the excess grout, leaving no visible film on the surface but filling all air holes.
    f. Keep the surface wet for a day after grouting and sack rubbing are completed.

5. Alternate methods of application and materials shall be subject to the approval of the **Architect**.

E. Interior Slab-on-Grade, typical u.o.n. - Smooth finish

1. Tamp slab surface with grid tamper and strike off to firm screeds; following stiffening of concrete, float to true surface and finish as follows:

    a. Two steel troweling operations; long-handled or Fresno trowel not permitted; first troweling performed when concrete will support operator on kneeboards; second troweling to follow concrete initial set for "non-burnished" or single-troweled for any concrete to receive floor

coverings and surface free from trowel marks, depressions, ridges or other blemishes, and shall be acceptable to finish flooring applicators.

b. Do not darken slab surface with over troweling or burnishing.
c. Install Sealers and penetrants after concrete has cured.
d. Where slab is not exposed or where appearance is not important, cracks larger than 1/32" wide shall be filled with cement grout and struck off level with surface.
e. Where slab is exposed and appearance is important, unsightly cracks shall be repaired in a manner satisfactory in appearance to Architect. If this cannot be accomplished, concrete shall be considered defective.
f. Patching not allowed on colored concrete.
g. Patching not allowed where structural strength is affected.
h. Patching of concrete is subject to approval by **Structural Engineer** and DSA.

F. Rough formed finish:

1. Applies at vertical concrete surfaces not exposed to view such as back of walls, fountain structures, and other areas to receive applied finishes or waterproofing.
2. Shall have no surface finish imparted by overlay plywood or any other formwork.
3. Surfaces shall be reasonably true to line and plane.
4. Fins and other rough spots at surfaces to receive applied finishes or membrane waterproofing shall be completely removed and the surfaces rubbed smooth, otherwise, surfaces shall be left with the texture imparted by forms.
5. Tie holes and defects shall be patched prior to final finishing.

G. Smooth Plywood Form Finish:

1. Applies to exposed foundations, typical, u.o.n.
2. Finish shall be true to line and plane
3. Arrangement of plywood sheets shall be orderly, symmetrical, as large as practical and free of torn grain or worn edges.
4. Fins and other rough spots at surfaces to receive applied finishes or membrane waterproofing shall be completely removed and the surfaces rubbed smooth, otherwise, surfaces shall be left with the texture imparted by forms.
5. Tie holes and defects shall be patched prior to final finishing.
6. Surface concrete shall be treated with 1 part muriatic acid, in three parts water solution, followed immediately by a thorough rinsing with clear water.
7. Surfaces which are glazed, have efflorescence, or traces of form oil, curing compounds or parting compounds shall be cleaned or treated to match other formed surfaces, except as otherwise indicated or specified.

H. Smooth Formed with **Very Light** Sandblasted Finish:

1. Applies at exposed vertical and horizontal surfaces of seat walls, retaining walls, concrete light standards, exterior stair and exterior ramp curbs, etc.
2. Finish shall be true to line and plane.
3. Shall have no surface finish imparted by overlay plywood or any other form framing.
4. Fins and other rough spots at surfaces to receive applied finishes or membrane waterproofing shall be completely removed and the surfaces rubbed smooth, otherwise, surfaces shall be left with the texture imparted by forms.
5. Patch defects prior to final finishing.
6. Tie holes and defects shall be patched prior to final finishing.

7. Texture shall match other sandblasted finishes.
8. Magnesium float or steel trowel exposed top of walls prior to sandblasting.

I. Smooth Formed with **Very Light** Broom Finish:

1. Applies to vehicular paving (roadways, trash enclosure pad/paving, etc.), exterior stairs and exterior ramp walking surfaces.
2. Shall have no surface finish imparted by overlay plywood or any other form framing.
3. Fins and other rough spots at surfaces to receive applied finishes or membrane waterproofing shall be completely removed and the surfaces rubbed smooth, otherwise, surfaces shall be left with the texture imparted by forms.
4. Patch defects prior to final finishing.
5. Texture to create slip resistant surface.
6. Magnesium float or steel trowel prior to Broom finishing.
    a. Clean brooms shall be used for final finishing.
        1. The broom shall be at least 3 feet wide and long enough to transverse between key joints, control joints or expansion joints.
        2. A stiff bristled broom shall be drawn from the opposite edge of the pavement, to the adjacent edge & producing face corrugations of uniform appearance and a 1/16-inch in depth max.
    b. Apply concrete paving topical applied sealer/protective coating where specified.

J. Exposed Aggregate Finish

a. Applies where indicated on drawings.
c. Seeded Pea gravel 3/8″ diameter smooth @ +/- 1/8″ variance
d. Wash surface for exposed finish.

K. Specialty Smooth Finish (where indicated on Drawings)

1. Smooth Plastic Liner Finish:
    a. Surface shall be smooth, concrete free of honeycombing, air pockets larger than 1/8 inch in diameter and fins.

3.14 DEFECTIVE CONCRETE

A. As directed by **Architect** & **Structural Engineer** and at no cost to **Owner**, remove defective concrete from site.
    1. No patching is to be done until surfaces have been examined by **Architect** & **Structural Engineer**.

B. Defective concrete is defined as follows:

1. Concrete not meeting 100 percent of the specified 28 day compressive strength.
2. Concrete exhibiting rock pockets, voids, spalls, cracks, exposed reinforcing, sand pockets or other such defects, which adversely affect strength, durability or appearance.
3. Concrete which is incorrectly formed, out of alignment or not plumb or level.
4. Concrete not containing required embedded items.
5. Concrete containing embedded wood or debris.
6. Concrete having patched voids, which were not filled under **Architect's** direction.
7. Concrete with the improper surface finish from that specified and/or indicated on the Drawings.
8. Concrete with exposed steel reinforcing at the finish exposed surfaces.

9. Concrete not meeting floor flatness and level required as herein specified and as required by each flooring manufacturer for each specific flooring location at time when floor finish is being installed.

C. Upon determination that concrete strength is defective:

1. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.

a. Cores of hardened concrete shall be taken and tested in accordance with ASTM Standards including ASTM C39 and ASTM C42 and additionally CBC Section 1905A.6.

1. Number and location of such cores shall be subject to the approval of **Architect** and **Inspector of Record**.

b. Cost of core sampling and testing will be paid for by the **General Contractor**.
c. "85 percent" reduction in ACI 318 Section 5.6.5.4 will not justify low cylinder tests.

D. Upon determining that concrete surface is defective, **General Contractor** may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the **Architect**, satisfactorily restore quality and appearance.

1. Total replacement required if concrete is dyed or stained.
2. No repair work shall begin until procedure has been reviewed by the **Architect** and **Structural Engineer** and **Inspector of Record**.
3. Patching must be approved by **Architect** and **Structural Engineer** and **Inspector of Record**.

E. If core tests indicate that concrete is below the strength specified, or if patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the **Owner**.

3.15 PROTECTION AND CLEAN UP (Typical)

A. Refer to Division 1 for protection and cleaning requirements.

B. Subcontractor will keep the work areas in a clean and safe condition so their rubbish, waste, and debris do not interfere with the work of others.

C. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

D. Perform work in accordance with manufacturer's recommendations, as herein specified and in accordance with drawings.

E. In the event of damage, immediately make all repairs and replacements necessary to the approval of the **Architect** and at no cost to the **Owner**.

F. After completion of work in this section, remove all erection equipment and implements of service, and debris.

1. Leave entire area in a neat, clean, acceptable condition.

G. Provide Guarantee/Warranties and Bonds as required in this specification section and as listed in Division 1 closeout submittal procedures.

H. Provide record drawings in accordance with Division 1 closeout submittal procedures.

I. Close out on-site inspection will be at the discretion of the **Architect** after they receive the **General Contractor's** request for Substantial Completion and receipt of the **General Contractor's** punch list.

END OF SECTION 03 30 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Steel pipe and tube railings.

B. Related Sections include the following:
   1. Division 3 Section “Cast-In-Place Concrete” for concrete foundation.
   2. Division 6 Section "Rough Carpentry" for wood blocking for anchoring railings.
   3. Division 9 Section “Painting” for field painting.

1.3 DEFINITIONS

A. Exterior: Defined as the following:
   1. Areas, locations, and surfaces that are unprotected, or exposed to environmental elements.
   2. Areas, locations and surfaces within uncontrolled environments.
   3. Areas, locations and surfaces of unconditioned spaces, including below grade/underground, partially-exposed, or “covered” parking areas.

1.4 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
   1. Steel: 72 percent of minimum yield strength.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
3. Infill of Guards:
   a. Uniform load of 25 lbf/sq. ft. applied horizontally.
   b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

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) (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. Americans with Disabilities Act (ADA), Title II or Title III.

B. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

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

D. Appearance: Galvanized articles shall be free from uncoated areas, blisters, flux deposits, acid and black spots, and dross inclusions. Lumps, projections, globules, or heavy deposits of zinc which will interfere with the intended use of the material will not be permitted.

1.7 COORDINATION AND SCHEDULING

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

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of pipe and tube railings that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings:
   1. Local iron fabricators.

B. Nonshrink, Nonmetallic Grout:
   1. 1107 Advantage Grout by Dayton Superior Chemical & Cement Products.
   2. Conset Grout by ChemMasters Specialty Construction Products.
   3. General-Purpose Grout by Symons.
   4. Or equal.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

B. Pipe: ASTM A 53, Type F or Type S, Grade A, Standard Weight (Schedule 40)
   1. Provide hot dipped galvanized finish for exterior installations.

C. Plates, Shapes, and Bars: ASTM A 36.

D. Castings: Either gray or malleable iron, unless otherwise indicated.
   1. Gray Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.
   2. Malleable Iron: ASTM A 47.

2.4 FASTENERS

A. General: Provide the following:
   1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

C. Anchors: Provide cast-in-place anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 Section “Painting”.

C. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

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

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded nonwelded either welded or nonwelded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form changes in direction as detailed.

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

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

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. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:
1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123 for hot-dip galvanized railings.
3. Comply with ASTM A 153 for hot-dip galvanized hardware.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:
1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
3. Interior Railings Indicated to Receive Zinc-Rich Primer (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. Field Finish: Comply with Division 9 Section "Painting" for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.7 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

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

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

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. (AWC) American Wood Council, "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 60 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 and/or Inspector of Record shall:

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

2. Inspect all bolted connections and holdowns bolts prior to wall cover installation.

3. Inspect elements of the seismic lateral force resisting system per CBC section 1705A.13.2.

a. Inspect floor and roof diaphragm nailing for nail size, spacing and penetration at plywood panel edges, and special nailing at collector and drag members.

b. Inspect shear wall nailing for nail size, spacing, edge distance and penetration at plywood panel edges, and nailing at holdown posts.

c. Inpscet all bolted connections of elements that are part of the seismic lateral force resisting system.

d. Inspect holdown bolts into wood and concrete.

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 20 00 - FINISH CARPENTRY

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work of this Section, as shown or specified, shall be provided by the Interior Contractor and shall be in accordance with the requirements of the Contract Documents and in accordance with the General Conditions of this Document.

1. Work includes coordination, fabrication, and installation of all interior exposed wood members shown on drawings and specified herein, including but not necessarily limited to the following:
   a. Standing and Running Trim
   b. Moldings
   c. Wood Shelving
   d. Wood Doors
   e. Miscellaneous Items
2. Related work in other Sections:
   a. Division #1 Sections
   b. Section 09 90 00 “Painting” for painting and staining of wood.

1.2 SUBMITTALS

A. All submittals shall be made according to Section 01300 and as described herein.

B. Submit the following for each item of Finish Carpentry:

1. Shop Drawings, indicating fabrication and installation methods, to include plans and elevations at not less than 1/2" = 1'-0" (1:20) scale and details at not less than 3" = 1'-0" (1:5) scale. Indicate required anchorage and blocking, accessory items, field dimensions, materials, and finishes. Indicate compliance with specification requirements. Indicate weight of any materials or systems to be suspended or which require support from structure.
2. Manufacturer's Product Data for all specialty items not manufactured by the Finish Carpentry Fabricator.
3. Two samples of each species and finish of wood specified. Samples shall be minimum 12" x 12" (300MM X 300MM) (or full member width and thickness) finished as specified on one face, one edge, and one end. Samples shall be fire- retardant treated wood where such has been specified or required by codes. Review will be for color and texture only; compliance with other requirements is the responsibility of Interior Contractor. Samples of finishes shall be applied on the appropriate wood or base material as will occur in the final Finish Carpentry item when installed.
4. A minimum of three different flitches of all veneers specified shall be submitted to the Architect for approval unless veneers have been previously selected by Architect or Owner and herein specified. Flitches shall indicate the color, grain, texture,

and finish range to be expected in the Project.

5. Where variations in wood and finish may occur, a minimum of three variations showing the extremes which may be expected of all wood and finishes as specified shall be submitted to the Consultant for approval. Minimum size: 12" x 20" (300 x 500 mm).
6. Where required by the Owner or Consultant the Interior Contractor shall provide full size mock- up of panel or woodwork assembly.
7. Interior Contractor shall submit to the Consultant three samples 20" (500m) minimum length of all moldings or molding assemblies to be used for the Project. These shall be full size and finished as specified in the Contract Documents.

1.3 QUALITY ASSURANCE

A. Comply with applicable provisions for Premium Grade as defined in the latest edition of the AWI Quality Standards for all materials, fabrication, and workmanship for all work of this Section.

B. All work of this Section shall be performed by skilled mechanics of the trade and shall be of the highest quality. Comply with applicable Industry Standards for all work and materials as specified. Such Industry Standards are to include but not be limited to the applicable provisions or standards of the following:

1. American Society for Testing and Materials (ASTM):
   a. E-84-70 Test for Surface Burning Characteristics of Building Materials.
2. Federal Specifications:
   a. FF-N-105B (2) Nails, Brads, Staples and Spikes:
   b. FF-S-111C (1) Screws, Wood
3. U.S. Department of Commerce:
   a. Product Standard (PS) 1-66 Softwood Plywood, Construction and Industrial.
   b. Product Standard (PS) 20-70 American Softwood Lumber Standard.
4. Architectural Woodwork Institute (AWI): Quality Standards and Guide Specification, latest edition (Premium).
5. National Electrical Manufacturers Association (NEMA):
6. LD-3-1975 Laminated Plastic Specification.
7. National Hardwood Lumber Associate (NHLA).
8. National Particleboard Association (NPA).
9. American Plywood Association (APA) plywood grades:
   a. for softwood plywood: Product standard PS-1.
   b. for hardwood plywood: Product standard PS-51

C. The Interior Contractor shall be responsible for obtaining and complying with all code and regulatory agency requirements for materials and methods.

D. The Interior Contractor shall be responsible for accurately obtaining all field dimensions related to his work prior to fabrication. Where discrepancies are found, he shall notify the Consultant immediately in writing.

E. All Finish Carpentry materials shall be stored in a dry, ventilated place, protected from the weather and complying with the temperature and humidity conditions specified by AWI Quality Standards.

F. Protect sanded and finished surfaces from soiling and damage during handling and installation.

G. Maintain requirements for heating, cooling and ventilation in installation areas as required to reach relative humidity necessary to maintain optimum moisture content specified for Finish Carpentry by AWI quality standards.

H. Provide temporary protection of all Finish Carpentry as required to protect work from damage.

PART TWO - PRODUCTS

2.1 MATERIALS

A. All woodwork materials shall be new and shall conform to the Premium Grade requirements of the AWIQuality Standards, latest edition.

B. All lumber shall be kiln-dried to the average moisture content as recommended by the AWI Quality Standards, latest edition appropriate for the regional climatic conditions of the projectsite.

C. All solid wood elements shall be clear, straight-grain lumber of the best grade of specified species as listed by the NHLA. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Solid wood elements shall also be according to the following, unless indicated otherwise on drawings and/or specifications:
   1. Specie of Face Woods receiving transparent finishes shall be as specified on the drawingsand shall be selected for specified grain with uniform color and grain suitable for use with the finished plywood with which it is used.
   2. Face Woods receiving opaque (Paint) finishes shall be Birch, Poplar or custom grade but otherwiseshall have same specification as solid stock for Face Woods above.
   3. Unexposed woods shall be Custom grade Poplar, kiln dried.
   4. All veneer core elements shall be clear straight-grain lumber of the best grade of the specified species as listed by the N.H.L.A. Lumber shall be freeof any defects which might impair serviceability, aesthetics, and/or finish. Where veneer differs on two sides, veneers shall be of similar thickness, density, and characteristics to prevent any warpage. Veneer core elements shall also be according to the following, unless indicated on drawings or specifications:
   5. Adhesives shall be water-resistant resin or approved equal; process shall be hot plate method using the following number of ply's to achieve specified thickness:
      a. 1/4" (6 mm) overall thickness shall be of 3- ply veneer core construction.
      b. 3/8" (9 mm) overall thickness shall be of 5- ply veneer core

construction.

c. 1/2" (12 mm) overall thickness shall be of5- ply veneer core construction.

d. 3/4" (20 mm) overall thickness shall be of7- ply veneer core construction.

e. 1" (25 mm) overall thickness shall be of 9-ply veneer core construction.

6. Where burl paneling is specified core must be cross banded with poplar prior to applying burl veneer.

7. Provide Douglas Fir or Poplar V-type solid edge trim on all exposed edges of plywood not designated to be surfaced by plastic laminate.

8. For Face Woods receiving transparent finishes, **Species shall be as specified on drawings;** faces shall be selected and matched by the Interior Contractor with respect to cutting lengths, uniformity of color, figure, and grain character. Face veneers shall not contain open joints, face depressions, glue stain or other manufacturing irregularities.

9. Face Woods receiving opaque finishes shall have custom grade (face veneer) Birch or Poplar select, but otherwise shall have same specification as Plywood for Face Woods (Paragraph 2.1.4.a).

10. Unexposed woods shall be Birch, Poplar or Douglas Fir, rotary cut, Unselect, good one side, interior type plywood, one side Grade A and one side Grade B; Grade A faces shall not contain plugs, knots, pitch pockets, splits, rough grain, or other open defects.

11. Wood for plastic lamination shall be minimum 3/4" (20 mm) Mahogany face core plywood, good one side.

12. All particle board shall be resin impregnated woodflakes of high-density construction as manufactured by U.S. Plywood Corporation, Shasta Division, Redding, California or approved equal and shall be 3/4" (20 mm) minimum thickness, unless otherwise specified.

13. For Enameled Face Woods: High density particle board may be substituted for plywood panels, unless specified otherwise on drawings.

14. For Unexposed Woods: High density particle board may be substituted for plywood panels, unless specified otherwise on drawings.

15 All Masonite shall be 1/8" (3 mm) thick tempered, as manufactured by Masonite Corporation, Chicago, Illinois, or an approved equal.

16. All peg-board shall be 1/8" (3 mm) thick tempered as manufactured by Masonite Corporation, Chicago, Illinois, unless otherwise specified.

17. All Finish Carpentry shall be finished as indicated on drawings and specifications. Transparent and Opaque Finishes shall match approved samples submitted according to Section 01 330 0 and Paragraph 1.2 above.

18. All plastic laminate finishes shall be of the quality, color and finish as indicated on the drawings and specifications.

D. Hardware and Accessories

1. All required hardware and accessories shall be furnished and installed by Interior Contractor and shall be as indicated on drawings and specifications. Where specific products are not specified in the Contract Documents the Interior Contractor shall recommend hardware to provide the function or condition indicated in the Contract Documents. Hinges, screws, clips and other mounting, attachments or fasteners to be concealed unless otherwise noted on drawings.

2. Interior Contractor shall submit samples of eachhardware item/type and accessory item/type to Consultant for approval according to Paragraph 1.2 above and Section 01300.
3. All Finish Carpentry hardware and accessories shall be installed in accordance with manufacturer's recommendations.

E. Other Materials
1. Interior Contractor shall be responsible for providing and installing all items and materials as indicated on drawings and specifications comprising all or part of the Finish Carpentry shown. Such items and materials shall be fabricated and/or installed according to manufacturer's recommendations and comply with applicable AWI Quality Standards and Industry Standards.
2. All paint and other finish material shall be pure, unadulterated and best quality from specified manufacturer as indicated on the drawings and specifications. (See Section 09920).
3. All finish materials shall be flame retardant or treated with flame-retardant process where required by local code. Should flame-retardant process cause change in color and effect on finish material, Interior Contractor shall notify the Consultant.
4. All finishes and processes shall be in compliance with code requirements for the location of installation.
5. All transparent finishes shall be alcohol, water andburn resistant.

PART THREE - EXECUTION

3.1 Examination of Conditions

A. The Interior Contractor shall be responsible for examination of the substrate and the conditions under which the work under this section is to be performed and notify the Consultant in writing of unsatisfactory conditions. Do not proceed with the work under this section until unsatisfactory conditions have been corrected.

3.2 FABRICATION

A. All work shall be performed in such manner as to fulfill the intent of the drawings and specifications.
B. All items to be mill fabricated per AWI Premium Grade specifications and according to the sizes and designs indicated on the drawings and specifications and assembled in single and complete units insofar as the dimensions thereof will permit shipment to and installation at the building. Large pieces requiring sectional construction shall have their several parts accurately fitted and aligned with each other and be provided with ample screws, glue and bolt blocks, tongues, grooves and splines, dowels, mortises and tenons, screws, bolts, or suitable means of concealed fastening, as required to render the work substantial, rigid and permanently secured in proper position to each related section.

C. Where necessary to fit at site provide ample allowancefor cutting and fitting.

Sufficient additional material shall be allowed to permit accurate scribing to walls, floors and related work; and due allowance made wherever possible for such shrinkage as may develop after installation. All single and sectional units shall be providedwith adequate cleating, blocking, crating and other forms of protection as required to preclude damages thereto during shipping and handling and installation.

D. Framing and blocking members shall be assembled with bolted and screwed connections and shall be secured to the structural backings withexpansion screws, or toggle bolts, as required, spaced and installed so as to insure ample strength and rigidity. Rails and stiles shall be mortisedand tenoned, work neatly mitered and membered, all butt joints made flush and smooth, and all permanent joints made up with water-resistant glue. All fixtures shall be assembled without face screws or nails, except where it may be necessary to attach trim items. All face screws or nails which are necessary to attach trimitems shall be countersunk and plastic wood or wood plugs used to cover heads, and the plug neatly touched up to match finish. The heads of all screws used in any assembly shall be countersunk below the surface.

E. All items where paint is required shall be shop spray finished, except where impractical or otherwise specified.

F. Backsides of all Finish Carpentry concealed by the building shall be given a prime coat of paint, color to closely approximate the value and hueof the face finish.

G. All shelving shall be adjustable unless indicated otherwise on drawings and specifications. Shelving standards shall be concealed unless otherwise noted.

H. Plastic Laminate edges shall be square, self-edged, or postformed as indicated on drawings. Metal trim is not acceptable. Edges shall be neatly beveled, joints shall be minimized in quantity and be made to a smooth hairline and puttied. Appearance of unsightly or excessive joints will be cause for rejection.

3.3 INSTALLATION

A. Installation at the Project shall be by skilledmechanics supervised by the Interior Contractor in accordance with accepted standards.

B. Install all Finish Carpentry straight, plumb, level and in true alignment except where otherwise indicated. Fit all joints closely and fasten all pieces rigidly in place. Nails shall be finish or casing nails. Countersink nail heads and leave ready for putty. Joints shall be neatly matched and mitered. Fill exposed joints prior to joining.

C. Finished size shall be as indicated on the drawings.

D. Surfaces shall be left free from hammer marks, free from warp, twist, open joints or other defects and shall be cleaned, scraped and sanded ready for finishing.

E. Lengths of all running trim shall be as long as practical.

F. Shim as required using concealed shims.

G. Cut Finish Carpentry to fit unless specified to be shop- fabricated or shop-cut to exact size. Where Finish Carpentry abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.

H. Distribute defects allowed in the quality grade specified to the best overall advantage, when installing job assembled items.

I. Install trim and moldings in single, unjointed lengths for openings and for runs less than maximum lengthof lumber available. For longer runs, use only one piece less than maximum length available in any straight run. Stagger joints in adjacent members.

J. Cope moldings at returns, miter interior angles and corners.

K. Attach Finish Carpentry securely in place with uniform joints providing for thermal and building movements. Attach to substrates by anchoring and fastening as shown, as required by recognized standards, and as follows:
   1. Nailing: Blind nail where possible. Use fine finishing nails where exposed. Set exposed nail heads for filling except for exterior wood which is to receive a natural finish (if any).
   2. Anchoring: Secure Finish Carpentry to anchors or blocking built-in or directly attached to substrates.

L. Where finishes are applied at job site, clean items and fill nail holes in preparation for finishes application. Where work is to receive a transparent finish, use matching wood filler.

M. For Fire-Retardant Finish Carpentry, handle, store and install in accordance with manufacturer's direction and as required to meet the required classification or rating. Provide special fasteners, adhesives and other accessories as tested and listed for the type of fire-retardant work indicated. Re-coat any and all cut surfaces with a heavy brush coating of the same compound used for wood treatment.

N. Fit Finish Carpentry to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow proper support.

O. Adjust all hardware for smooth operation.

3.4 CLEANING AND POROTECTION

A. Clean shop finished work, touch-up finish as requiredand remove and refinish damaged or soiled areas of finish.

B. Protect installed Finish Carpentry from damage by workof other trades until Owner's acceptance of the work. Subcontractor to advise Interior Contractor of procedures and precautions for protection of materials and installed work from damage and of the required temperature/humidity conditions which must be maintained

during the remainder of the construction period in areas of Finish Carpentry installations.

END OF SECTION 06 20 00

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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).
   3. Plastic-laminate cabinets (PL-3).

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 9 Section “Finish Schedule” for color selection.

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 *(standard for classrooms)*
      b. Premium Grade cabinets *(reception areas and board rooms etc)*
   2. Cabinet Types:
      a. Frameless *(front edge of cabinets are edge banded)*
         1. Reveal Overlay
   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) (2018 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) (2018 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.
   3. *Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs. Reference Chapter "D" of the Architectural Woodwork Standards*

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.
   2. Substitutions: Under provisions of Section 1

B. High-Pressure Decorative Laminate: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
   1. Formica Corporation. (Basis of Design)
   2. Wilsonart International; Div. of Premark International, Inc.
   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
   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.
B. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.
C. WI Door and Drawer Front Style:

1. Flush Reveal overlay.

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. Color: 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

D. Edge Treatment: Self-edge banded (for laminated).
E. Laminate Substrates: Medium-density fiber board (MDF). Do not use plywood.
F. 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 S REQUIREMENTS

A. See Division 01
B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
C. Section 07 90 05 - Joint Sealers: Sealant materials and installation techniques

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.
F. Sustainable Design Submittals: Provide the following information by filling out the Special Environmental Requirements Product Submittal Form located in Appendix A of Section 01 35 43 Special Environmental Requirements
   1. Low Emitting Materials
   2. Local/Regional Materials
   3. Recycled Materials

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.

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

SECTION 07 56 10

ROOFING REPAIR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide all labor, equipment, and materials to maintain and protect the existing roof system.

1.02 RELATED SECTIONS

A. Section 07 6200- Sheet Metal Flashing and Trim: Sheet metal flashing and trim.

1.03 SYSTEM DESCRIPTION

A. Roofing work including but not limited to:
   1. Flashing installation at new penetrations.
   2. Repair of damaged or deteriorated flashing.
   3. Install fill insulation where needed, base sheet and modified cap sheet per detail.
   4. All flashings to consist of one ply of base sheet set in mastic covered by an additional layer of modified bitumen membrane.
   5. Roof coating:
      a. Acrylic/urethane hybrid in field of roof.
   6. Vent coating.

1.04 PERFORMANCE REQUIREMENTS

A. Make roof weathertight and watertight. All drainage to flow off roof, do not permit standing water.

1.05 SUBMITTALS

A. See Section 013000 - Submittals, for submittal procedures.
B. Product Data: Provide manufacturer's data sheets documenting conformance with specified requirements.
C. Manufacturer's Field Reports: Indicate deviations or deficiencies observed during site visits, record method of resolution.
D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
   1. Manufacturer will inspect completed work.
B. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.
   1. Installer's Field Supervision: Require Installer to maintain a full-time Supervisor/Foreman on job site during all phases of bituminous sheet roofing work and at any time roofing work is in progress, proper supervision of workmen shall be maintained. A copy of the specification shall be in the possession of the Supervisor/Foremen and on the roof at all times.
C. Respond immediately to correction of roof leakage during construction. If the contractor does not respond within 24 hours, the Owner has the right to hire a qualified contractor and backcharge the original contractor.

1.07 PRE-INSTALLATION MEETING

A. Convene two weeks before starting work of this section. Meet at Project site with Installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in the around roofing that must precede or follow roofing work (including mechanical work if any), Architect/Owner, roofing system manufacturer's representative, and other representatives directly

concerned with performance of the Work, including (where applicable) Owner's insurers, test agencies, and governing authorities. Objectives to include:

B. Review preparation and installation procedures and coordinating and scheduling required with related work.
   1. Review methods and procedures related to roofing work.
   2. Review structural loading limitations of deck.
   3. Review roofing systems requirements (drawings, specifications, and other contract documents).
   4. Review required submittals, both completed and yet to be completed.
   5. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   6. Review required inspection, testing, certifying, and material usage accounting procedures.
   7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including provision of temporary roofing over occupied spaces.
   8. Record discussion of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
   9. Review notification procedures for weather or non-working days.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
B. Store and handle roofing materials in a dry, well-ventilated, weather-tight place to ensure no possibility of significant moisture exposure. Store rolls of felt and other sheet materials on pallets or other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (not polyethylene).
C. Do not leave unused rolled goods on the roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.
D. Contractor shall secure all material and equipment on the job site. If material or equipment is stored on the roof, the contractor shall ensure that the integrity of the deck is not compromised at any time. Damage to the deck caused by the contractor will be the sole responsibility of the contractor and will be repaired or replaced at his expense.

1.09 PROJECT CONDITIONS

A. Coordinate roof repair installation with size, location and installation of roof mounted work.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Weather Condition Limitations: Do not apply materials during inclement weather or when a 40% chance of precipitation is expected.
B. Materials shall be stored at room temperature until immediately prior to application when the ambient temperature is 40°F or below. Discontinue the application if the material can not be stored at a temperature which permits even distribution during application.
C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 WARRANTY

A. Correct defective Work within two year period after Date of Substantial Completion.
B. Provide two year contractor warranty for roof repair.
C. Provide letter from manufacturer with original warranty number and approval of repair work.

PART 2 PRODUCTS

2.01 MATERIALS as Manufactured by The Garland Company 925-784-6701.

A. Base Ply and Base Flashing Ply: Flexbase 80.

B. Field and flashing Cap sheet: Stressply EUV FR Mineral, SBS (Styrene-Butadiene-Styrene) mineral surfaced rubber modified roofing membrane reinforced with a dual fiberglass scrim and polyester mat, ASTM D-6162 Type III Grade G.
C. Asphalt Primer: Garla-Prime VOC - V.O.C. compliant, ASTM D-41.
D. Flashing and Field adhesive: Green-Lock Plus Flashing Adhesive
E. Reinforcing Fabric: Gar-Mesh Fiberglass Mesh
F. Roof coatings
   1. Roof field and flashing: Pyramic Plus LO acrylic.
G. Insulation: ½" Densdeck Prime.
H. Insulation fasteners: per roof system manufacturer.
I. Soft Metal Flashings: Green-Weld PVB
   1. Adhesive: Green-Lock Structural Adhesive

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate surfaces to receive roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Roof System Manufacturer and Installer.

3.02 INSTALLATION

A. Powerwash roof repair area.
B. In repair area, use a torch to burn off existing coating system. Remove coating a minimum of 8" from edge of roof cut to ensure ability to adhere new membrane to existing roof system.
C. Prepare all penetrations to be flashed and where shown on the drawings, with asphalt primer at the rate of one hundred (100) square feet per gallon. Allow primer to dry tack free.
D. Where roofing is removed, mechanically attach coverboard to deck to match height of existing finished roof surface.
E. All plies will be adhered with the following:
   1. With mastic at a rate of 4-6 gallons per 100 square feet. The base flashing and the modified membrane will be used as the flashing and nailed off 8" O.C. at all vertical surfaces.
F. Seal perimeter of roof with Green-Lock Flashing. Min. ½" deep at edge.
G. The entire sheet of the base flashing and the flashing membrane must be solidly adhered to the substrate.
H. Seal all vertical laps of flashing membrane with a three-course application of Green-Lock Flashing and fiberglass mesh. Broadcast minerals into 3 course application.
I. Seal junction of flashing membrane and roof with a three-course application of Green-Lock Flashing and mesh. Broadcast minerals into 3 course application.
J. Solar and pipe penetrations and stanchions shall be flashed with Green-Weld PVB per manufacturers installation instructions.
K. Coating work:
   1. Apply Pyramic LO at a rate of 1.5 gal per sq. Apply two coats.
   2. Coat all flashing all flashing within that area indicated on the roof plan with Pyramic LO.

3.03 INTERFACE WITH OTHER WORK

A. Coordinate with roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices to be coordinated with the roofing work as specified in other sections to avoid conflict or omission in waterproofing systems and to provide watertight installation.

3.04 FIELD QUALITY CONTROL

A. At completion of roofing installation and associated work, meet with Installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each parting attending.

C. The Roofing System Manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor at a negotiated price.

D. If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.

E. Repair or replace (as required) deteriorated or defective work found at time above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. The Contractor is to notify the Owner upon completion of corrections.

G. Following the final inspection, acceptance will be made in writing by the material manufacturer.

3.05 CLEANING and PROTECTION

A. Clean roof and surrounding surfaces.

B. Protect installed work from subsequent construction operations.

C. Do not permit traffic over unprotected roof surface.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Gutters and downspouts.
2. Parapet caps
3. Roof to wall
4. Roof Edge Flashings
5. Riser/ curb caps
6. Sheet metal flashing and trim not specifically specified in other sections.

B. Related Sections:
1. Division 7 Section "Joint Sealants"
2. Division 7 section Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Division 7 Section "Flexible Sheet Flashing"
4. Division 9 Section "Painting" for field painting.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter-flashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.

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 11 - 2022 California Green Building Standards Code (Calgreen Code)
10. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)

B. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

D. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.

5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheet metal flashing and trim that fails in materials or workmanship within specified warranty period.
1. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 2 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. Manufacturers
1. Fairview Architectural LLC; Edgeline: www.fairview-na.com
2. Garland Co. Inc
3. Morin
4. Substitutions: See Section01 60 00-Product Requirements.

B. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
a. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
2. Surface: Smooth, flat and mill phosphatized for field painting.
3. Gage: 24 GA. minimum unless noted otherwise to be thicker. Except mechanical curb and deck caps to be 22 GA.
4. Color: As selected by Architect from manufacturer's full range.

5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single—component, solvent—release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

H. Splash Block: Precast concrete

2.3 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.

1. Products:
   a. Fry Reglet Corporation.
   b. Heckmann Building Products Inc.
   c. Hickman, W. P. Company.
   d. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
   e. Or equal.
2. Material: Galvanized steel, minimum 0.022 inch thick.
3. Provide one of the following types depending on substrates:
   a. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
   b. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
   c. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
   d. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
   e. Accessories:
      1) Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
      2) Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.
D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored from compatible, noncorrosive metal.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

G. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat- stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
   1. Gutter Style: SMACNA designation and as indicated on drawings.

B. Downspouts: Field painted Schedule 10 pipe.

C. Overflow Parapet Scuppers:
   1. Size: 3 (Three) times the size/area of roof drains.
   2. Opening: Minimum opening height of 4 inches with inlet flow line located 2 inches above low point of adjacent roof.

D. Overflow Spout/ Snoot: JW Smith Model #1770 or approved equal.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   5. Install sealant tape where indicated.
   6. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
   1. Coat with bituminous coating or by other permanent separation as recommended by SMACNA where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes:
   1. Wood: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
   2. Concrete or Masonry: ¼" Tapcon concrete screw anchors 1" minimum to 1-3/4" maximum penetration galvanized for interior use, stainless steel for exterior use.

E. Seal joints as shown and as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg. F, set joint members for 50 percent movement each way. Adjust setting

proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
4. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

C. Downspouts:
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
2. Provide elbows at base of downspout to direct water away from building.
3. Provide Cast-iron downspouts at exposed walls from grade to 8’ above finish grade.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 65 26 - SELF ADHERING SHEET FLASHING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: Self adhering waterproofing membrane and primer to provide moisture protection in masonry cavity wall construction and frame construction.

1.2 REFERENCES

A. ASTM E96 – Test Methods for Water Transmission of Materials
B. ASTM D412 – Test Methods for Vulcanized Rubber And Thermoplastic Rubbers and Thermoplastic Elastomers – Tension
C. ASTM D903 – Peel or Stripping Strength of Adhesive Bonds

1.3 SUBMITTALS

A. Provide in accordance with Section 01 33 00- Submittal Procedures
   1. Product Data and Installation Instructions
   2. (MSDS) Material Safety Data Sheets
   3. 2 inch by 2 inch minimum membrane sample

1.4 PRODUCT HANDLING

A. Storage - Protect product from inclement weather or excessive heat
B. Temperature not to exceed 150 degrees or go below 25 degrees Fahrenheit

PARTS 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. CLARK/HAMMERBEAM Corp., PO Box 381, Dedham, MA 02027; Tel/781-461-1946; www.fiberwebflashing.com
B. Manufacturers of equivalent products submitted and approved in accordance with Section 01 25 00-Substitution Procedures

2.2 PRODUCTS

A. A self-adhering waterproofing membrane with a siliconized release liner; AQUA FLASH GREEN as manufactured by FIBERWEB Div. CLARK- HAMMERBEAM Corp.
   1. Composition: a clear, VOC free adhesive bonded to a 30% recycled post-industrial woven and coated industrial film
   2. Total thickness: 40 mils
   3. Widths: 12”, 16”, 18”, 24”, 36” (select appropriate width)
   4. Ultra Violet Exposure: 2,000 hrs. – no change
   5. Peel Adhesion of Adhesive Bonds: 10.25 lbs.lf/in. in accordance with ASTM D903
   6. Moisture Vapor Transmission: .02 grains max/sq.ft./hr. in HG in accordance with ASTM E96
   7. Bursting Strength: 383 psi in accordance with ASTM D-751
   8. Elongation: 30% in accordance with ASTM D412C
   9. Tensile Strength (Grab): 205 lbs in accordance with ASTM D-751
B. Primer: To be used for substrate preparation as recommended by waterproofing membrane

manufacturer

PART 3 - EXECUTION

3.3. INSPECTION

A. Concrete substrate must be fully cured prior to membrane application
B. Substrate is to be reasonably smooth, free from any loose material, debris, oils and is to be completely dry

3.4 PREPARATION

A. Prepare substrate surface in accordance with manufacturer's recommendations
B. Primer Application
   1. Follow manufacturer's recommendations

3.5 MEMBRANE APPLICATION

A. Cut membrane into 8-10 foot lengths
B. Remove release liner. Apply membrane starting from the lowest point and work upwards.
C. All laps are 2 ½" inch minimum
D. Use a steel hand roller to secure membrane firmly in place eliminating wrinkles and air pockets
E. Cut membrane flush with outside surface of building when no drip plate is installed
F. Inside and outside corners must be covered with two layers of membrane and sealed with mastic (see details/drawings)

END OF SECTION

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 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
   2. Division 7 Section "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
   3. Division 8 Section "Glazing" for glazing sealants.
   4. Division 9 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   5. Division 9 Section "Ceramic Tile" for sealing tile joints.
   6. 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 from the date of 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" (White)
4. Pecora Corp., "860" or "894NST" (White).

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".

G. Type H - Sound and Fire Protective Rated Moldable Putty Pads as wall opening protective materials when code required in fire-rated walls.
2. CP 506 Smoke and Acoustic Sealant by Hilti
3. CS-SL SA Smoke and Acoustic Sleeve by Hilti

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 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform [5] tests for the first [100 feet] of joint length for each kind of sealant and joint substrate.
      b. Perform one test for each [100 feet] of joint length thereafter or one test per each floor per elevation.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
   4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
   5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT LOCATION SCHEDULE

SCHEDULE

Type	Location	Color
Type A - Acrylic Latex Cure	All interior joints not otherwise scheduled	To match adjacent surfaces
Type B - Butyl	Under thresholds	Black
Type C - One-Part Nonacid Curing Silicone	Exterior door, entrance & window frames. [Exterior & Interior vertical joints in concrete & masonry] [metal flashing]	[Black] {Bronze] [Aluminum] [Stone] [Grey] [ ] [to match adjacent material]
Type D - Neutral-Curing Silicone	Joints within glazed curtain wall system, skylight framing system, aluminum entrance systems, windows and glass and glazing	[Translucent] [White] [Black] [Aluminum] [Bronze]
Type E - Mildew-Resistant Silicone	Interior joints in ceramic tile and at plumbing fixtures	[White] [Translucent] [Almond]
Type F - Multi-part Pourable Urethane	Exterior & interior joints in horizontal surfaces of concrete; between metal & concrete masonry and mortar	[Black] [Limestone] [Stone] [To match adjacent material]
Type G - Acoustical Sealant	In sound rated walls between stud track/runner and adjacent construction. Between outlet	Transluscent

Type	Location	Color
	boxes and gypsum board.	
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

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SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wood doors, fire-rated and non-rated.

B. Glass lite frames.

C. Door louvers.

1.2 REFERENCES

A. WDMA I.S.1 - Industry Standard For Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).

B. NFPA 80 - Fire Doors and Windows.

C. UBC - Uniform Building Code.

D. UL 10C - Fire Tests of Door Assemblies.

E. WI - Woodwork Institute: Manual of Millwork.

F. 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 6 - 2022 California Energy Code
5 Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
6 Title 24 CCR, Part 10 - 2022 California Existing Building Code
7 Title 24 CCR, Part 11 - 2022 California Green Building Standards Code (Calgreen Code)
12. Title 24 CCR, Part 12 - 2022 California Reference Standards
13. Americans with Disabilities Act (ADA), Title II or Title III

1.3 QUALITY ASSURANCE

A. Conform to requirements of WI Manual of Millwork, Section 12 and 13, Premium (P) Grade except where otherwise indicated.

B. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.

C. After completion issue a WI Certified Compliance Certificate for Installation.

1.4 REGULATORY REQUIREMENTS

A. Conform to UBC for fire-rated doors.

B. Fire Door Construction: Conform to UL 10C.

C. Installed Doors: Conform to NFPA 80 for fire-rated class indicated on Drawings.

1.5 SUBMITTALS

A. Submit under provisions of Division #1.

B. Shop Drawings shall bear the WI Certified Compliance Label on the first page of each set. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers.

C. Submit two Samples 12 inches x 12 inches in size illustrating each species and finish specified.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect products under provisions of Section 01 87 00.

B. Package, deliver, and store doors in accordance with WI requirements as set forth in Technical Bulletin 419-R.

1.7 WARRANTY

A. Provide manufacturer's standard lifetime warranty under provisions of Section 01 70 00 for solid core doors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS, FLUSH FACED DOORS

A. Eggers Industries, Inc.

B. Marshfield Door Systems, Inc.

C. Algoma Hardwoods, Inc.

D. Substitutions: Under provisions of Section 01 60 00

2.2 DOOR and FRAME CONSTRUCTION

A. Solid Non-rated Core: Solid wood block, framed block glued, or solid particleboard.

B. Solid, Special Function Core: Labeled fire performance type.

C. Construction: 5-ply, with face veneer applied vertically over wood veneer cross banding.

D. Flush Interior Door Veneer: Birch for paint grade and species to match adjacent wood or simulated wood finishes; Satin sheen. Color as selected by Architect to match other doors on site.

E. Rated Wood Frames: Manufacturer's standard 20 minute labeled frames, species to match door, U.O.N. installed in accordance with manufacturer's installation instructions. Fire rated frames shall be machined for hardware at factory.

2.3 GLASS LITE FRAMES

A. 20 Ga. Cold rolled steel

2.4 ADHESIVES

A. Exterior and Interior Doors: WI Type I.

2.5 FABRICATION

A. Fabricate non-rated wood doors to requirements of WI Manual of Millwork, Section 12 and 13, in the WI Grade specified.

B. Fabricate fire rated doors per manufacturer's standard construction, and labeling agency requirements.

C. Premachine doors for finish hardware.

D. For fire rated doors with mineral cores, provide solid wood blocks for hardware reinforcement at lock edge, mid-height push bar, and at top of door for closer.

E. For fire-rated doors with mineral cores, provide solid wood blocking for thru-bolted hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors in accordance with WI Manual of Millwork Sections 12 and 13 and WI Technical Bulletin 420-R.

B. Conform to WI requirements for fit tolerances.

C. Coordinate installation of glass and glazing.

D. Install door louvers.

E. Adjust doors for smooth and balanced movements.

F. Install fire doors in accordance with NFPA 80.

3.2 INSTALLATION TOLERANCES

A. Edge clearance for swinging doors shall not exceed the following:
   1. Between door and frame at head and jamb
      a. 1/8 inch
   2. Between edge of pair of doors
      a. 1/8 inch
   3. At door sill with threshold
      a. 3/8 inch

4. At door bottom and surface of nominal floor covering per NFPA 80 and at doors requiring an undercut as indicated on Drawings.
   a. 5/8 inch

B. Frame installation tolerance shall not exceed the following:

1.	Squareness	±1/16 inch
2.	Alignment	±1/16 inch
3.	Plumbness	±1/16 inch
4.	Diagonal Distortion	±1/32 inch

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:
   1. Division 7 Section "Roof Accessories" for roof hatches.
   2. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
   3. Division 9 Section “Painting” for field applied finishes.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

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 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)
11. Title 24 CCR, Part 12 - 2022 California Reference Standards (Partial List)
12. NFPA 24 - Private Fire Service Mains (California Amended), 2016 Edition.
13. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2016 Edition (Note: See UL Standard 1971 for "Visual Devices").
14. NFPA 80 - Fire Door and Other Opening Protectives, 2016 Edition.
15. NFPA 101- Life Safety Code. 2015 Edition
16. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives, 2016 Edition
17. 2010 ADA Standards for Accessible Design
18. Americans with Disabilities Act (ADA), Title II or Title III.

B. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

C. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. NFPA 252 or UL 10B for vertical access doors and frames.
   2. ASTM E 119 or UL 263 for horizontal access doors and frames.

D. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of access doors and frames that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Doors and Frames: Subject to compliance with requirements, provide products by one of the following:
   1. Acudor.
   2. Milcor Inc.
   3. Nystrom, Inc.
   4. Karp Associates Inc.
   5. Or equal (Reference substitution requirements in Section 01 60 00)

2.2 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.
   1. ASTM A 123, for galvanizing steel and iron products.
   2. ASTM A 153, for galvanizing steel and iron hardware.

B. Steel Sheet: Cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Factory Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   2. Field Finish: Factory prime for field painting as specified in Division 9 "Painting".

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Acudor UF-5000 non-fire-rated access door and frame:
   1. Size: As indicated on Drawings or as required for access.
   2. Material: 14 gage door, 16 gage mounting frame.
   3. Door: Flush to frame - rounded safety corners.
   4. Frame: One-piece outer frame welded to mounting frame.
   5. Hinge: Continuous, concealed.
   6. Latch: Cylinder lock and key.
   7. Factory Finish: 5-stage iron phosphate preparation with prime coat of gray.
   8. Field Finish: Comply with Division 9 Section “Painting”.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
   1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.
B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.
B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

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 -Zone 4 20 PSF and Zone 5 22 PSF wind load (0 to 10’-0” from corners); 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 at the Lobby
    a. Basis of Design:
    Manufacturer: Arcadia, Inc., 2301 E Vernon, Vernon, CA.
    Telephone 323/269-7300, Fax 323/269-7390.

    Product: AG451T Series, 2″ x 4-1/2″ **Thermally broken**; center glazed system, screw spline, shear block, compensating stick or punched opening fabrication for 1″ glass.

2. Aluminum-Framed Storefront at the Locker Room
    a. Basis of Design:
    Manufacturer: Arcadia, Inc., 2301 E Vernon, Vernon, CA.
    Telephone 323/269-7300, Fax 323/269-7390.

    Product: AG451T Series, 2″ x 4-1/2″ **Thermally broken**; Off Set glazed system, screw spline, shear block, compensating stick or punched opening fabrication for 1″ glass.

3. Or approved thermally broken equal products by:
    a. Old Castle
    b. Vistawall
    c. U.S. Aluminum Systems

d. Traco Co., Inc.

B. System Description
1. 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.
2. 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.
3. 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. Doors: Arcadia AG451T Series
a. Hardware: Per Section 08710 -DOOR HARDWARE; mohair pile weatherstripping where required.
E. Finish: Clear Anodized, Architectural Class I.
F. Glass: As shown; refer to Section 08810 -GLASS AND GLAZING.

G. Fasteners: As recommended by manufacturer to meet wind pressures shown.
H. Protective Coatings:
    a. General: Bituminous, FS TT-C-494, Type II.
    b. Gasketing: Chromate type.
I. 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.

J. 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.

D. Doors:
Hang doors level, plumb, straight in vertical plane, with proper fit and alignment and moving parts operating freely without bind.
Weatherstripping: Seal doors, meeting stiles of pairs of doors, door tubing, and stops on frames and astragals.
Thresholds: Set in bed of sealant and secure.
Hardware: Per Section 087100 -DOOR HARDWARE.

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

SECTION 08 51 13 ALUMINUM WINDOWS

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. Furnish and install aluminum architectural windows complete with hardware and related components as shown on drawings and specified in this section.
   1. All windows shall be from a single source.
   2. Manufacturers requesting approval to bid their product as an equal must submit the following information fifteen days prior to close of bidding.
      i. A sample window, 24" (610 mm) x 36" (914 mm) single unit, as per requirements of the spec's and architect.
      ii. Test reports documenting compliance with requirements of Section 1.5.

B. Glass and Glazing
   1. Reference Section 08 81 00 for Glass and Glazing.

1.3 RELATED WORK

A. Section 07 26 00 – Vapor Retarders
B. Section 07 27 00 – Air Barriers
C. Section 07 60 00 – Flashing and Sheet Metal
D. Section 07 92 00 – Joint Sealants
E. Section 08 11 16 – Aluminum Doors and Frames
F. Section 08 40 00 – Entrances, Storefronts, and Curtain Walls
G. Section 08 80 00 – Glazing

1.4 Reference Standards

American Architectural Manufacturer's Association (AAMA):

a. AAMA/WDMA/CSA101/I.S.2/A440, North American Fenestration Standard/Specification for Windows, Doors, and Skylights, Includes Update No. 1.
b. AAMA 502-12 Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
c. AAMA 609 Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

d. AAMA 611 Voluntary Standards for Anodized Architectural Aluminum.
e. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

2. Glass Association of North America (GANA):
   a. GANA 01-0300 Proper Procedures for Cleaning Architectural Glass Products.
3. ASTM International (ASTM):
   a. 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.
   b. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   c. ASTM E547 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
   d. ASTM F588 Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
4. National Fenestration Rating Council (NFRC):
   a. NFRC 100A Procedure for Determining Fenestration Attachment Product U-Factors.
   b. NFRC 200A Procedure for Determining Attachment Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
   c. NFRC 500 Procedure for Determining Fenestration Product Condensation Resistance Values.
5. US Green Building Council (USGBC):

a. LEED NC Version 2.2, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations

1.5 LABORATORY AND TESTING REQUIREMENTS

A. Test Units
   1. Air, water, and structural test unit shall conform to requirements set forth in AAMA/WDMA/CSA 101/I.S.2/A440-08 and manufacturer's standard locking/operating hardware and insulated glazing configuration.
   2. Thermal test unit sizes shall be 47" (1200 mm) x 59" (1500 mm). Unit shall consist of a single hung window.

B. Test Procedures and Performances
   1. Windows shall conform to all AAMA/WDMA/CSA 101/I.S.2/A440-08 requirements for the window type referenced in 1.01.B. In addition, the following specific performance

requirements shall be met.

2. Air Infiltration Test
   a. With sash closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
   b. Air infiltration shall not exceed .10 cfm/SF (.50 l/s•m^2) of unit.
3. Water Resistance Test
   a. With sash closed and locked, test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 12 psf (580 Pa).
   b. There shall be no uncontrolled water leakage.
4. Uniform Load Deflection Test
   a. With sash closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 70.0 psf (3351 Pa), positive and negative pressure.
   b. No member shall deflect over L/175 of its span.
5. Uniform Load Structural Test
   a. With sash closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 105.0 psf (5027 Pa), both positive and negative.
   b. At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.
6. Forced Entry Resistance
   a. Windows shall be tested in accordance to ASTM F 588 or AAMA 1302.5 and meet the requirements of performance Grade 40.
7. Condensation Resistance Test (CRF)
   a. Test unit in accordance with AAMA 1503.1.
8. Condensation Resistance (CR)
   a. With ventilators closed and locked, test unit in accordance with NFRC 500-2010.
9. Thermal Transmittance Test (Conductive U-Factor)
   a. With ventilators closed and locked, test unit in accordance with NFRC 100-2010.

C. Project Wind Loads
   1. The system shall be designed to withstand the following loads normal to the plane of the wall:
      a. Per DSA wind load requirements*.
         *See Structural Engineer's plans/ Calculations

1.6 QUALITY ASSURANCE

A. Provide test reports from AAMA accredited laboratories certifying the performance

B. Test reports shall be accompanied by the window manufacturer's letter of certification, stating the tested window meets or exceeds the referenced criteria for the appropriate window type listed.

1.7 SUBMITTALS

A. Make submittals in accordance with section 01 33 00 Submittal Procedures

B. Product Data: Manufacturer's standard specifications and descriptive literature, including:

1. Certified test laboratory reports to show compliance with requirements.
    a. Windows with sizes exceeding the gateway sizes do not qualify under these tests.
    b. Windows manufactured with configurations different than the tested configurations do not qualify under these tests; windows can be tested for performance outside the already tested gateway sizes.
    c. Windows with hardware different from what is referenced on the test reports do not qualify under these tests.
2. Manufacturer's standard head, jamb and sill details.
3. Installation methods.
    a. Submit manufacturer's written installation instructions.

C. Manufacturer's Certificates: Submit certified independent testing agency reports indicating window unit meets or exceeds specified performance requirements.

D. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Provide shop drawings indicating details of construction and installation including, but not limited to, window location chart, window schedule, size, muntin type and design, sections and details of multiple window assemblies, hardware, glazing details, frame type, STC, glass types, screens and handing operation.

E. Samples

1. Window Section:
    a. Submit 8 × 8 inch minimum corner section sample of frame for each glazing type specified.
    b. Sample will be used to verify construction, corner joint, frame finish and color.
    c. Quantity [5].
2. Glazing:
    a. Insulated Glazing [12 × 12 inch].
3. Finish: AAMA 611 Anodized Architectural Coatings; AAMA 2605 for Organic Coatings on Aluminum Extrusions.
    a. [Class 1 Anodized].
    b. [Kynar].

F. Manufacturer's written instructions, including:

1. Delivery, storage and handling recommendations.
2. Preparation and installation recommendations.

G. Installer's Experience: Submit verification of evidence of work similar to work of this section.
H. Warranty: Fully executed, issued in [Owner's] name and registered with manufacturer, including:
   1. Manufacturer's [10 year] warranty from date of accepted delivery, covering defects in materials.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum [10 years] experience in producing aluminum windows of the type specified.
   1. Manufacturer must be certified through the PPG Certified Window Fabricator Program.
B. Installer Qualifications: Licensed contractor with a minimum [3 years] experience installing similar windows.
C. Mock-ups: Provide and install at job site a mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color and workmanship standard.
   1. Size: 8 x 8-inch.
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into final construction upon Owner's and Architect's approval.
   4. Modify mock-up as required to produce acceptable work.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery
   1. Deliver materials in accordance with manufacturer's written instructions and labeling.
   2. Deliver materials in manufacturer's original, unopened, undamaged containers or packaged with identification labels intact, and product name and manufacturer clearly visible and in sizes to suit project.
B. Storage
   1. Store materials upright and protected from exposure to harmful environmental conditions, clean, dry, frost-free and at manufacturer's recommended temperature and humidity levels.
C. Handling:
   1. Exercise care during off-loading and installation to avoid damage and marring of finishes.
   2. Handle in a manner to evenly distribute material load and prevent twisting, ending and cracking of windows doors and associated parts.

3. Replace materials damaged during handling.

1.10 WARRANTIES

A. Total Window Installation
   1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total window installation which includes that of the windows, hardware, glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water, and structural adequacy as called for in the specifications and approved shop drawings.
   2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at their expense during the warranty period.

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. 1. Failures include, but are not limited to, the following: a.
   1. Failure to meet performance requirements.
   2. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
   3. Faulty operation of movable sash and hardware.
   4. Deterioration of materials and finishes beyond normal weathering.
   5. Failure of insulating glass.

C. Window Material and Workmanship
   1. Provide written guarantee against defects in material and workmanship for 10 years from the date of final shipment.

D. Glass and Glazing Units
   1. Provide written warranty for insulated glass units that they will be free from obstruction of vision as a result of dust or film formation on the internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship.
   2. Warranty period shall be for 10 (ten) years.

A. Finish
   1. Warranty period shall be for 10 years from the date of final shipment.
   2. Provide organic finish warranty based on AAMA standard 2605. M

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Acceptable Manufacturer: **All Weather Architectural Aluminum**, 777 Aldridge Road, Vacaville, California 95688; Phone: (707) 452-1600; Fax: (707) 452-1616; Email: info@allweatheraa.com; Website: www.allweatheraa.com
   2. Basis for Design: **Series 5000 by All Weather Architectural Aluminum**
   3. Related Requirements:
      1. Section 01 60 00 Product Requirements for submitting comparable product submittals for products by listed manufacturers.
      2. Information, including sample (size and configuration per Architect's requirements) must be submitted for consideration a minimum of 10 days before project bid date.
   4.
   5. Boyd Aluminum Manufacturing.
   6. Kawneer North America; an Alcoa company.
   7. Wausau Window and Wall Systems.

B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 MATERIALS

A. Aluminum
   1. Extruded aluminum shall be 6063-T6 alloy and tempered.

B. Hardware
   1. For casement windows: [4 bar heavy duty stainless steel concealed hinges, die cast zinc cam handles with pole ring][worm gear rotary control operator with butt hinges and side mounted multi-locking handle].
   2. For awning windows: [4 bar heavy duty stainless steel concealed hinges, die cast zinc cam handles with pole ring] [worm gear rotary hardware with loose pin concealed hinges and side mounted locking handles].

C. Weather-Strip
   1. All primary weather-strip shall be 64A durometer black santoprene bulb insert

B. Glass
   1. Insulated glass shall be 1" thick per Section 08 80 00 GLAZING.

C. Thermal Barrier
   1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is

defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.

2. Sills are thermally broken with thermal struts, consisting of glass reinforced polyamide nylon, mechanically crimped in raceways extruded in the exterior and interior extrusions. All other frames and sash are thermally broken using the latest technology in two-part, high-density polyurethane. A nonstructural thermal barrier is unacceptable.

2.3 FABRICATION

A. General
   1. All aluminum frame and vent extrusions shall have a minimum wall thickness of .080″ (2 mm). Frame sill members shall have a minimum wall thickness of .094″ (2.3 mm).
   2. Mechanical fasteners, welded components, and hardware items shall not bridge thermal barriers.
   3. Depth of frame shall not be less than 3 7/8″ (98 mm).

B. Frame
   1. Frame components shall be mechanically fastened.

C. Sash
   1. All sash extrusions shall have a minimum wall thickness of .080″ (2 mm).
   2. All horizontal sash extrusions shall be tubular.
   3. Corner connections shall be mechanically fastened.

D. Screens
   1. Screen frames shall be extruded aluminum.
   2. Screen mounting holes in the window frame shall be factory drilled.
   3. Screen mesh shall be aluminum or fiberglass.
   4. Painted roll formed aluminum frames finished to match window frames, factory-drilled/tapped to receive screen attachment hardware.
      A. Screen hardware:
         a. Charcoal fiberglass.
         b. Wire.
         c. Ultraview™.

E. Glazing
   1. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, extruded aluminum, glazing bead. The glazing bead must be isolated from the glazing material by a gasket.
   2. All units shall be glazed with a minimum of 1/2″ glass bit.

D. Finish
1. Aluminum to AA DAF-45, Class 1, clear anodized.
a. Finish all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designation. **Selection by Architect**

OR

2. Dual Finish: Inner frame color **Selection by Architect**; Outer frame color **Selection by Architect**

b. Color shall be as selected by architect.

PART 3 EXECUTION

1.1 Inspection

A. Job Conditions
1. Verify that openings are dimensionally within allowable tolerances, plumb, level, clean, provide a solid anchoring surface, and are in accordance with approved shop drawings.

1.2 INSTALLER

A. Use only licensed installers who have training and experience with similar work of this Section.

1.3 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for aluminum window installation in accordance with manufacturer's written recommendations.
1. Visually inspect substrate.
2. Verify openings are dimensionally correct and within allowable tolerances, and substrates are plumb, level and clean.
3. Verify in the presence of the Architect that anchoring surface is in accordance with approved shop drawings.
4. Inform Architect of unacceptable conditions immediately upon discovery.
5. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Architect.
6. Starting window installation implies substrate conditions are acceptable for Work of this Section

1.2 Installation

A. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications.

B. Plumb and align window faces in a single plane for each wall plane, and erect windows and materials square and true. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

C. Adjust windows for proper operation after installation.

D. Furnish and apply sealants to provide a weather tight installation at all joints and intersections and at opening perimeters. Leave all exposed surfaces and joints clean and smooth.

3.3 Anchorage

A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

2.4 Protection and Cleaning

A. After completion of window installation, windows shall be inspected, adjusted, put into working order and left clean, free of labels, dirt, etc. Protection from this point shall be the responsibility of the general contractor.

END OF SECTION 08 51 13

SECTION 08 71 00 – DOOR HARDWARE
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
B. This Section includes the following, but is not necessarily limited to:

1. Door Hardware, including electric hardware.
2. Thresholds, gasketing and weather-stripping.

1.03 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

A. 2022 California Building Code, CCR, Title 24.
B. BHMA – Builders' Hardware Manufacturers Association
C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
D. DHI – Door and Hardware Institute
E. NFPA - National Fire Protection Association.

1. NFPA 80 - Fire Doors and Other Opening Protectives
2. NFPA 105 - Smoke and Draft Control Door Assemblies

F. UL - Underwriters Laboratories.

1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

G. WHI - Warnock Hersey Incorporated
H. SDI - Steel Door Institute

1.04 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
C. Submit schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. Include a Cover Sheet with;
   a. Job Name, location, telephone number.
   b. Architects name, location and telephone number.
   c. Contractors name, location, telephone number and job number.
   d. Suppliers name, location, telephone number and job number.
   e. Hardware consultant's name, location and telephone number.
2. Job Index information included;

a. Numerical door number index including; door number, hardware heading number and page number.
b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
c. Manufacturers' names and abbreviations for all materials.
d. Explanation of abbreviations, symbols, and codes used in the schedule.
e. Mounting locations for hardware.
f. Clarification statements or questions.
g. Catalog cuts and manufacturer's technical data and instructions.

3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)					
			(a) 1 Single Door #1 - Exterior from Corridor 101	(b) 90°	(c) RH
			(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea	(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea	Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

(a) - Single or pair with opening number and location. (b) - Degree of opening (c) - Hand of door(s) (d) - Door and frame dimensions and door thickness. (e) - Label requirements if any. (f) - Door by frame material. (g) - (Optional) Hardware item line #. (h) - Keyset Symbol. (i) - Quantity. (j) - Product description. (k) - Product Number. (l) - Fastenings and other pertinent information. (m) - Hardware finish codes per ANSI A156.18. (n) - Manufacture abbreviation.

D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
F. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
G. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
H. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.
I. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.05 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project

and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Responsible for detailing, scheduling and ordering of finish hardware.
2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.

1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.

1.06 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

B. Hardware items shall be individually packaged in manufacturers’ original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.

1.07 WARRANTY

A. Provide warranties of respective manufacturers’ regular terms of sale from day of final acceptance as follows:

1. Mechanical Locksets: Ten (10) years.
2. Closers: Thirty (30) years.
3. Mechanical Exit devices: Ten (10) years.
4. All other hardware: Two (2) years.

1.08 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.09 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least one week prior to beginning work of this section.

B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District Personnel, and Project Inspector.

C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Item	Manufacturer	Acceptable Substitutes
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal
Closers	LCN	Or Approved Equal
Protection Plates	Ives	Trimco, BBW, DCI
Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.02 MATERIALS

A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.

1. Hinges shall be sized in accordance with the following:
   a. Height:
      1. Doors up to 42" wide: 4-1/2" inches.
      2. Doors 43" to 48" wide: 5 inches.
   b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
   c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Continuous Hinges: As manufactured by Ives, an Allegion Company. UL rated as required.

C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.

1. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
   a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
   b. Offset lever pull – minimum 1,600 foot pounds without gaining access
   c. Vertical lever impact – minimum 100 impacts without gaining access

2. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
3. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
4. Cylinders: Refer to "KEYING" article, herein.
5. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
6. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
7. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw capable of UL listing of 3 hours on a 4' x 10' opening. Provide proper latch throw for UL listing at pairs.
8. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
9. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
10. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
11. Provide wired electrified options as scheduled in the hardware sets.
    a. 12 through 24 volt DC operating capability, auto-detecting
    b. Selectable EL (fail safe)/EU (fail secure) operating mode via switch on chassis
    c. 0.230A (230mA) maximum current draw
    d. 0.010A (10mA) holding current
    e. Modular / "plug in" request to exit switch
12. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

D. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of ¼" diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3" long screws. ANSI A156.5, 2001 Grade 1 certified.

E. Exit devices: Von Duprin as scheduled.

1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
3. Mechanism case shall have an average thickness of .140".
4. Compression spring engineering.
5. Non-handed basic device design with center case interchangeable with all functions.
6. All devices shall have quiet return fluid dampeners.
7. All latchbolts shall be deadlocking with ¾" throw and have a self-lubricating coating to reduce friction and wear.
8. Device shall bear UL label for fire and or panic as may be required.
9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130" thickness, match lockset lever design.
11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
12. Furnish glass bead kits for vision lites where required.
13. All Exit Devices to be sex-bolted to the doors.
14. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
    a. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.

F. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.

1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16” steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
5. Closers shall be installed to permit doors to swing 180 degrees.
6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.
8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. Per 11B-404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.

G. Door Stops:

1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

H. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.

I. Thresholds: As Scheduled and per details.

1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 “Thermal and Moisture Protection”.
3. Use ¼” fasteners, red-head flat-head sleeve anchors (SS/FHSL).
4. Thresholds shall comply with CBC Section 11B-404.2.5.

J. Seals: Provide silicone gasket at all rated and exterior doors.

1. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
3. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on “S” labeled Positive Pressure door assemblies.

K. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

L. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.03 KEYING

A. Furnish a Proprietary Schlage masterkey system as directed by the owner or architect. Key system to be designated and combinated by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.

B. A detailed keying schedule is to be prepared by the owner and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.

C. Establish a new masterkey system for this project as directed by the keying schedule.

D. Furnish all cylinders in the Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI)

E. Furnish construction keying for doors requiring locking during construction.

F. Furnish all keys with visual key control.

1. Stamp key “Do Not Duplicate”.
2. Stamp (BHMA) key symbol on key.

G. Furnish all cylinders with visual key control.

1. Stamp (BHMA) key symbol on side of cylinder (CKC).

H. Furnish mechanical keys as follows:

1. Furnish 2 cut change keys for each different change key code.
2. Furnish 1 uncut key blank for each change key code.
3. Furnish 6 cut masterkeys for each different masterkey set.
4. Furnish 3 uncut key blanks for each masterkey set.
5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
6. Furnish 1 cut control key cut to each SKD combination.

I. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.

1. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.

J. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.

1. Furnish CL77R for use with FSIC Schlage cylinders.

2.04 FINISHES

A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.05 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
D. Provide expansion anchors for attaching hardware items to concrete or masonry.
E. All exposed fasteners shall have a phillips head.
F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
B. Beginning of installation means acceptance of existing conditions.
C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer’s furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2018 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
B. Use the templates provided by hardware item manufacturer.
C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.
D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

3.03 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
B. Clean adjacent surface soiled by hardware installation.
C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 HARDWARE LOCATIONS

A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.05 FIELD QUALITY CONTROL

A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.
C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Protection Plates & Door Stops
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

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	PANIC HARDWARE	CDSI-PA-AX-99-L-KC-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
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. 03

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		

HARDWARE GROUP NO. 04

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. 05

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. 06

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. 07

1	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ADA STOREROOM LOCK	ND81TD RHO	626	SCH
1	EA	INTERCHANGEABLE CORE	VERIFY PERMANENT CORE WITH DISTRICT	626	
1	EA	OH STOP	100S (ONLY @ LOCATIONS WHERE FS436/FS438 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	FS436/FS438 AS REQ.	626	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

END OF SECTION 08 71 00

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. Fire Rated Steel Windows
   3. Doors.

B. Related Sections include the following:
   1. Division 8 Section “Steel Doors and Frames”.
   2. Division 8 Section “Flush Wood Doors”.
   3. Division 8 Section "Aluminum Windows."

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.
2. Glass Identification: Provide Identification on each pane of class to demonstrate compliance with CBC 2403.1. Provide permanent identification of each pane of safety glazing to demonstrate compliance with CBC 2406.3

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 “Steel Doors and Frames.”
2. Division 8 Section “Flush Wood Doors”.
3. Division 8 Section "Aluminum Windows."

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) (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

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. Vitro Architectural Glass (Basis of Design).
   2. Guardian.
   3. Pilkington.
   4. Visteon.
   5. 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. Obscure Glazing:
   1. "Burlap" manufactured by Hordis Brothers, Inc.; .200″ patterned glass, PPG Industries, Inc., or equal.
      a. Install on outer face of insulated units

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

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 “Flexible Sheet Flashing” for flashing.
   2. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
   3. Division 8 Section “Steel Doors and Frames”.

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 12 - 2022 California Reference Standards (Partial List)
   10. Title 19 C.C.R., Public Safety, SFM Regulations.
   11. 2010 ADA Standards for Accessible Design
   12. 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 25 13)

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 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.

2.6 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.

2.7 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

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. Abuse Resistant (GWB-VHI).
   3. 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: (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 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. Gypsum-Pacific
   4. PABCO Corporation
   5. 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.
   1. Thickness: 5/8”
   2. Long Edges: Tapered

B. Type X:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

C. 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.
   2. 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
   2. Tile trims
   3. Grout
   4. Solid polymer thresholds installed as part of tile installations.
   5. Waterproof membrane for tile installations.
   6. Cementitious backer units installed as part of tile installations.

B. Related Sections include the following:
   1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
   2. Division 9 Section "Gypsum Board" for moisture resistant gypsum board.

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. 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).

C. 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).

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.

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.

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 MOISTURE RESISTANT GYPSUM INSTALLATION

A. Install moisture resistant gypsum and treat joints according to TCA W244 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 moisture resistant gypsum and treat joints to comply with TCA W244 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.

END OF SECTION 09 30 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 stair accessories.
   3. 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.

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] <Insert dimension> for every [500 linear feet] <Insert dimension> 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

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. *Johnsonite (Basis of Design)*
   2. *Burke Mercer Flooring Products, Division of Burke Industries Inc.*
   3. *Flexco.*
   4. *Roppe Corporation, USA.*
   5. 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

C. 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: As selected by Architect from full range of industry colors

2.3 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 nosing for resilient flooring, reducer strip for resilient flooring, ,joiner for tile and carpet, and transition strips

C. Locations: Provide vinyl molding accessories in areas where transition occur between two separate materials.
D. Colors and Patterns: As selected by Architect from full range of industry colors

2.4 INSTALLATION MATERIALS

A. 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."

B. 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.
C. 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: 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 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 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

Substitute the HIGHLIGHTED numbers for 2nd and 3rd Coats for LOW VOC ChiPs and Leed Projects ; 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.
   2. Division 9 Section “Finish Schedule” for color selection.

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) (2018 IBC, as Amended by CA
4. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 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 11 00 – VISUAL DISPLAY SURFACES

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. Coordinate the work of this Section with related trades.
Verify applicable dimensions, clearances and heights at the jobsite.
Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified herein and as necessary to complete the work required by project conditions, including but not limited to:

1. Visual Display Boards.
2. Tack Boards
3. Marker Boards
4. Bulletin Board
5. Adhesives and accessories, as required, specified or not.

1.2 REFERENCE STANDARDS

A. 2022 California Code of Regulations (CCR), Title 24, California Building Standards Commission (CBSC), www.bsc.ca.gov current edition at time of permit issuance.

B. Title 24, California Code of Regulations, California Building Standards Commission

C. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines, current version.

D. CBC Energy Code, California Code of Regulations, Title 24, Part 6

E. Refer to specifications, including, but not limited to Section 01 42 00 – Reference Codes & Standards

1.3 PERFORMANCE, TESTING AND INSPECTION

A. **General**:
1. Comply with manufacturer's standards.
2. Comply with Building Code.
3. Job site inspections shall be done as herein specified and as listed in drawings.
4. Testing shall be done as herein specified and as listed in drawings.
5. Tackable wall panels shall be tested per CBC Table 803.13

1.4 SUBMITTALS

1. 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.

1.5 QUALITY ASSURANCE

A. Refer to Section 01450- Quality Control.

B. **Contractor** /Installer/Fabricator shall have been in business for five (5) years providing/installing/finishing projects of similar size and complexity.

C. **Manufacturer** shall have been in business for five (5) years providing/installing/finishing projects of similar size and complexity.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01630- Product Delivery, Storage and Handling.

B. Deliver and store products suitable wrapped or packaged to protect against damage. Do not remove protective coverings until time of installation.

1. Protect finish and edges in accordance with panel manufacturer's recommendations.
2. Store material in accordance with panel manufacturer's recommendations.

1.7 JOB CONDITIONS

A. Field verify that all components, backing, etc. provided by others are installed correctly before proceeding with installation of products as herein specified.

1.8 PROTECTION

A. Protect finish surfaces at all times from surfaces and material adjacent to them.

B. Finish work defaced with other materials on surface shall be replaced.

C. Protect work under this section from damage by other trades.

1.9 GUARANTEE / WARRANTY

A. Refer to Section 01700– Record Documents and Project Closeout.

B. Furnish **one (1)** year written warranty signed by manufacturer and installer agreeing to repair and/or replace work which has failed as a result of defects in materials or workmanship.

1. Upon notification of **Owner** within the warranty period, such defects shall be repaired and replaced at no cost to the **Owner** .

1.10 RELATED WORK/SECTIONS

A. Related work includes, but is not limited to the following:

1. Wall Substrate
2. Wall Backing

B. Related Sections include, but are not limited to the following:

1. Section 09 29 00 – Gypsum Board and Sheathing Substrates (includes tackable wall sheathing and cement backer boards)

1.11 OPERATION AND MAINTENANCE DATA

A. Submit as part of project closeout:

1. Complete instructions regarding maintenance of the materials, finishes, etc.
2. Comply with Section 01 78 39 - Record Documents and Project Closeout.

1.12 SEQUENCING AND SCHEDULING

A. Schedule work and sequence with **General Contractor**.

B. Schedule required testing, prior to the installation of materials, components, etc.

PART 2 - **PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

A. Single source responsibility, specified items shall be from one manufacturer.

B. Acceptable manufacturer shall be one of the following and as listed herein and in Drawings:

1. Claridge Products, www.claridgeproducts.co
2. Platinum Visual Systems
3. Reviewed Equivalent by **Architect** and/or **Owner**.

a. Substitutions and deviations shall require **Architect's Owner's** approval and shall be given in letterform.

b. Refer to Division 1, Section 01 33 00 – Submittals, Substitutions and Deviations.
c. Proposed alternate products must be equal in terms of chemical composition, color, finish, configuration, performance standards, etc.

C. All products and materials indicated shall be installed according to current listed specification requirements and manufacturers specifications/recommendations.

D. Refer to drawings, details, and other related specification section whether listed or not.

E. Details shall set basic requirements for size and configuration of systems.

2.2 MATERIAL SCHEDULE

A. **Bulletin boards**:

1. Mfgr: Claridge
2. Series: 2700
3. Model: 2748
4. Size: 4′-0″ x 8′-0″ (confirm size with **Owner**)
5. Material:

a. Frame: Solid Oak with radius edges.

1) Finish: Stain finish as selected by Architect from mfgr's std. colors.
2) Size: 1-3/4″ wide x ¾″ deep

b. Board:

1) Finish:

a) Fabric: Hook-Fab - 100% nylon
b) Model No: 930
c) Color: As selected from mfgr's std. colors by **Architect**.

2) Material: Cork, manufacturer's standard
3) Type: CO-RC

c. Accessories: None

1) Mounting:

a) "Z" bar hanger at top & rubber bumpers at bottom of board.
b) Install over material with solid blocking at substructure

B. **Markerboard**:

1. Mfgr: Claridge

a. Series: GLASS
b. Model: GB8X4MGMW
c. Size: 4′-0″ x 8′-0″ *(confirm size with* **Architect***)*
d. Material:

1) Frameless
2) Board: Mfgr's Glass White board back painted color to be selected by Architect from standard colors

3) Accessories:

a) MGM-TI – Clear anodized Accessory Tray
b) MGM-REMSQ-G – Rare Earth Magnets, Gray
c) MGM-ME1 – Magnetic Eraser

e. Mounting:

1) "Z" bar hanger at top & rubber bumpers at bottom of board.
2) Install over material with solid blocking at substructure

C. **Tack Walls**:

1. Mfgr: Claridge

a. Series:
b. Model: TW1D
c. Size: 4'-0" x 8'-0" *(confirm size with* **Architect***)*
d. Material: Guilford Fabric on duracore

1) Edge wrapped (seamless)

e. Mounting:
1) See detail 7/2A-921

PART 3 - **EXECUTION**

3.1 INSPECTION / EXAMINATION

A. Verification of Conditions:

1. Examine areas and conditions under which work is to be performed.
2. Identify conditions detrimental to proper or timely completion of work and coordinate with **General Contractor** to rectify.

B. Surface:

1. Examine and verify that receiving conditions of substrate have no defects or errors, which would result in poor or potentially defective application or cause latent defects in workmanship.

3.2 COORDINATION

A. **General Contractor** shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.3 PREPARATION

A. Refer to Section 01040- Project Coordination.

B. Take all necessary measurements in the field to ensure proper dimensions.

C. Coordinate work under this Section with other trades whose work adjoins, combines, or aligns with same.

3.4 INSTALLATION

A. Prior to installation, carefully inspect and verify that the installed work of other trades is complete to the point where this installation may properly commence.

B. Verify that specified items may be installed in accordance with the approved design.

3.5 INSTALLATION OF IDENTIFYING DEVICES

A. Install identifying devices in accordance with accepted Shop Drawings.

B. Attach signs with (TEKS) self-drilling screws as specified and/or when appropriate for surfaces and backing. Place as indicated and in accordance with accepted shop drawings.

3.6 ADJUSTING AND CLEANING

A. Remove all dust, dirt, finger marks, etc. from installed items, as recommended by manufacturer.

B. Keep building and premises free from accumulated waste materials, rubbish and debris resulting from work herein. Upon completion of said work, remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from said work, and legally dispose of off site.

3.7 PROTECTION AND CLEAN UP

A. Refer to Section 01710- Protection and Cleaning.

B. Keep areas of work free from debris daily as work progresses.

1. Subcontractor will keep the work areas in a clean and safe condition so his rubbish, waste and debris do not interfere with the work of others.

C. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

1. Clean adjacent surfaces free of caulking or sealant with mechanical action or solvent as necessary, avoiding damage to other materials.

D. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no cost to the **Owner**.

E. After completion of work in this section, remove all erection equipment and implements of service, and debris.

1. Leave entire area in a neat, clean, acceptable condition.

F. Furnish the **Owner** a copy of the manufacturer's maintenance instructions.

1. Instructions shall include recommended cleaning materials and method of application.

G. Provide record drawings in accordance with Section 01700 – Record Documents and Project Closeout.

H. Provide Guarantee / Warranties and Bonds as required in this specification section and as listed in Section 01700– Record Documents and Project Closeout.

END OF SECTION 10 11 00

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)
   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) (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
   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 (Reference substitution requirements in Section 01 60 00

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
      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".

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 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

SECTION 10 14 19 DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.01 PRINCIPAL WORK IN THIS SECTION

- The requirements of the **Owner's** General and Supplementary Conditions, Division 0 and Division 1 requirements apply to the work of this Section.
- Coordinate the work of this Section with related trades.
- Verify applicable dimensions at the jobsite.
- Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified herein and as necessary to complete the work required by project conditions, including but not limited to:
  - Exterior Monument Sign.

1.02 REFERENCE STANDARDS

A. 2022 California Code of Regulations (CCR), Title 24, California Building Standards Commission (CBSC) www.bsc.ca.gov current edition at time of permit issuance.
B. Title 24, California Code of Regulations, California Building Standards Commission
C. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines, current version.
D. CBC Energy Code, California Code of Regulations, Title 24, Part 6, California Building Standards Commission
E. Title 24, Chapter 11 – California Green Building Standards Code
   - Non-residential new construction
     - All occupancy types

1.03 PERFORMANCE, TESTING AND INSPECTION

A. **General:**
   - Comply with manufacturer's standards.
   - Comply with Building Code.
   - Job site inspections shall be done as herein specified and as listed in drawings.
   - Testing shall be done as herein specified and as listed in drawings.
   - Refer to Division 1 for additional requirements for DSA projects.

B. **Sustainability:**
   - Refer to Division 1 sustainability requirements.
   - Refer to product criteria identified herein.

1.04 SUBMITTALS

- Refer to Division 1 for substitution, deviation and/or submittal procedures.
- Submit O&M (Operation and Maintenance) manuals in accordance with Division 1 requirements and as herein specified.
- Refer to Division 1 for sustainability requirements
- Submit the following for **Architect's** review:
  - Manufacturer product data and technical data sheets
  - Shop drawings:
    - Plans, sections, and elevation views of all sides; information to include, but not be limited to:

- □□ Overall Size
- □□ Letters – style/text type, size, color and finish
- □□ Numbers – style/text type, size, color and finish
- □□ Text schedule
- □□ Electrical and Lighting components
- □□ Mounting and Installation Instructions
- □□ Footings and mix designs, when applicable

□□ Samples:

- □□ 4" x 6" Samples of each type of individual letter, number and general sign surface materials and finishes
  - □□ Where color selection is required, provide color samples for **Architect's** selection of signage colors.
- □□ Samples of each type of cast, cut or engraved letters, numbers, or monolithic sign

□□ Mock-up

- □□ Provide mockup of dimensional letter signage in each type and mounting configuration.
  - □□ Erect at location approved by **Architect**.
- □□ Mock-up shall be part of final construction once approved by **Architect**.

1.05 QUALITY ASSURANCE

□□ Refer to Division 1 for quality control requirements.

□□ Contractor / Installer / Fabricator shall have been in business for **five (5)** years providing / installing / finishing projects of similar size and complexity.

□□ Manufacturer shall have been in business for **five (5)** years providing/installing/finishing projects of similar size and complexity.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

□□ Refer to Division 1 for product delivery, storage and handling requirements.

□□ Deliver and store products suitable wrapped or packaged to protect against damage. Do not remove protective coverings until time of installation.

- □□ Protect finish and edges in accordance with panel manufacturer's recommendations.
- □□ Store material in accordance with panel manufacturer's recommendations.

1.07 JOB CONDITIONS

□□ Field-verify that all components, backing, etc. by others are installed correctly to proceed with installation of products as herein specified.

1.08 PROTECTION

A. Protect finish surfaces at all times from surfaces and material adjacent to them.
B. Finish work defaced with other materials on surface shall be replaced.
C. Protect work under this section from damage by other trades.

1.09 GUARANTEE / WARRANTY

A. Refer to Division 1 for closeout submittal procedures.
B. Furnish initial **one (1)** year written warranty signed by manufacturer and installer agreeing to repair and/or replace work which has failed as a result of defects in materials or workmanship.

□□ Upon notification of **Owner** within the warranty period, such defects shall be repaired and replaced at no cost to the **Owner**.

C. Furnish manufacturer's additional warranty agreeing to repair and/or replace work which has failed as a result of defects in materials or workmanship.
□□ Upon notification of **Owner** within the warranty period, such defects shall be repaired and replaced at no cost to the **Owner.**

1.10 RELATED WORK/SECTIONS

□□ Related work includes, but is not limited to the following:
- □□ Site Work, Parking, Flatwork, etc.
- □□ Finish grading
- □□ Landscaping
- □□ Site lighting

□□ Related Sections include, but are not limited to the following:
- □□ Division 1
- □□ Section 03 30 00 – Cast in Place Concrete
- □□ Section 08 41 00 – Aluminum Entrances and Storefronts
- □□ Section 09 29 00 – Gypsum Board
- □□ Section 09 90 00 – Painting and Coating

1.11 OPERATION AND MAINTENANCE DATA

□□ Submit as part of project closeout:
- □□ Complete instructions regarding maintenance of the materials, finishes, etc.
- □□ Refer to Division 1 for closeout submittal procedures.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

□□ Single source responsibility, specified items shall be from one manufacturer for each product type.

□□ Acceptable manufacturers shall be one of the following and as herein listed and in Drawings:
- □□ Signage Manufacturer:
  - □□ Western Sign Company, Inc, www.westernsign.com, Diamond Springs, CA
  - □□ Signs and Graphic Design, www.singsandgraphic.com, Chico, CA
  - □□ Pacific Neon, www.pacificneon.com, Sacramento, CA
- □□ Reviewed Equivalent by **Architect**.
  - □□ Substitutions and deviations shall require **Architect's** approval and shall be given in letterform.
  - □□ Refer to Division 1 for substitution, deviation and/or submittal procedures.
  - □□ Proposed alternate products must be equal in terms of chemical composition, color, finish, configuration, performance standards, etc.

□□ All products and materials indicated shall be installed according to current listed specification requirements and manufacturers specifications/recommendations.

□□ Refer to drawings, details, and other related specification section whether listed or not.

□□ Details shall set basic requirements for size and configuration of systems.

2.02 MATERIALS – DIMENSIONAL LETTERS

A. **Sign Type BI-1**

B. Materials:
- □□ Clear Anodized Aluminum
- □□ Painted Aluminum

C. Lighting:
- □□ None

D. Character style (letters and numerals):
- □□ Channel – fabricated three-dimensional characters
- □□ Flat Cutout characters – dimensional character cut from sheet or plate stock

E. Sign Schedule:
- □□ Sign "BI-1"
  - □□ To read: "Rio Vista Elementary School"
  - □□ Font Style: Arial
  - □□ Height: 36"
  - □□ Depth/Thickness: 1"
  - □□ Font Style, Size and Text to be verified with **Architect** and **Owner** prior to fabrication.
  - □□ Mounting:
    - □□ Individual Pin Mounted Letters
      - □□ Cast-in
      - □□ Welded
      - □□ Mechanically Fastened
    - □□ Internally Lit, Individual Pin Mounted Letters
      - □□ Cast-in
      - □□ Welded
      - □□ Mechanically Fastened
    - □□ Pin Mounted connected letters/numerals
      - □□ Cast-in
      - □□ Welded
      - □□ Mechanically Fastened
    - □□ Internally Lit, Pin Mounted connected letters/numerals
      - □□ Cast-in
      - □□ Welded
      - □□ Mechanically Fastened
    - □□ Refer to drawings for location and substrate information.
- □□ Sign "BI-2"
  - □□ To read: "Building __" (refer to site plan for building #)
  - □□ Font Style: Arial
  - □□ Height: 24"
  - □□ Depth/Thickness: 1"
  - □□ Font Style, Size and Text to be verified with **Architect** and **Owner** prior to fabrication.
  - □□ Mounting:
    - □□ Individual Pin Mounted Letters
      - □□ Cast-in
      - □□ Welded
      - □□ Mechanically Fastened

- □□ Internally Lit, Individual Pin Mounted Letters
  - □□ Cast-in
  - □□ Welded
  - □□ Mechanically Fastened
- □□ Pin Mounted connected letters/numerals
  - □□ Cast-in
  - □□ Welded
  - □□ Mechanically Fastened
- □□ Internally Lit, Pin Mounted connected letters/numerals
  - □□ Cast-in
  - □□ Welded
  - □□ Mechanically Fastened
- □□ Refer to drawings for location and substrate information.

F. Logos:
- □□ Artwork to be provided by **Owner**
  - □□ Logo, Font Style, Size, and Text to be verified with **Architect** and **Owner** prior to fabrication.
- □□ Mounting:
  - □□ Individual Pin Mounted Letters
    - □□ Cast-in
    - □□ Welded
    - □□ Mechanically Fastened
  - □□ Internally Lit, Individual Pin Mounted Letters
    - □□ Cast-in
    - □□ Welded
    - □□ Mechanically Fastened
  - □□ Pin Mounted connected letters/numerals
    - □□ Cast-in
    - □□ Welded
    - □□ Mechanically Fastened
  - □□ Internally Lit, Pin Mounted connected letters/numerals
    - □□ Cast-in
    - □□ Welded
    - □□ Mechanically Fastened
  - □□ Refer to drawings for location and substrate information.

PART 3 - EXECUTION

3.01 INSPECTION/EXAMINATION

A. Verification of Conditions:
- □□ Examine areas and conditions under which work is to be performed.
- □□ Identify conditions detrimental to proper or timely completion of work and coordinate with **General Contractor** to rectify.

B. Surface:

□□ Examine and verify that receiving conditions of substrate have no defects or errors, which would result in poor or potentially defective installation or cause latent defects in workmanship.

3.02 COORDINATION

A. Refer to Division 1 for project coordination requirements.
B. **General Contractor** shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.03 PREPARATION

□□ Prepare work, substrates, etc. in accordance with manufacturer's recommendations.
□□ Take all necessary measurements in the field to ensure proper dimensions, layout and location of sign.
□□ Coordinate work under this Section with other trades whose work adjoins, combines, or aligns with it including, but not limited to:
  □□ Lighting.

3.04 INSTALLATION

□□ Prior to installation, carefully inspect and verify that the installed work of other trades is complete to the point where this installation may properly commence.
□□ Verify that specified items may be installed in accordance with the approved design.
□□ Sign shall be installed in concrete footing and in compliance with plan details.
□□ Sign shall be constructed in accordance with reviewed Shop Drawings.

3.05 ADJUSTING AND CLEANING

□□ Remove all dust, dirt, finger marks, etc. from finishes, characters and numerals, as recommended by manufacturer.
□□ Keep area / site free from accumulated waste materials, rubbish and debris resulting from work identified herein.
  □□ Upon completion of said work, remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from said work, and legally dispose of off-site.

3.06 PROTECTION AND CLEAN UP

A. Refer to Division 1 for protection and cleaning requirements.
B. Subcontractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others.
C. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
D. Perform work in accordance with manufacturer's recommendations, as herein specified and in accordance with drawings.
E. In the event of damage, immediately make all repairs and replacements necessary to the approval of the **Architect** and at no cost to the **Owner**.
F. After completion of work in this section, remove all erection equipment and implements of service, and debris.
G. Leave entire area in a neat, clean, acceptable condition.

H. Provide Guarantee/Warranties and Bonds as required in this specification section and as listed in Division 1 closeout submittal procedures.
I. Provide record drawings in accordance with Division 1 closeout submittal procedures.
J. Close out, on-site inspection will be at the discretion of the **Architect** after he receives the **General Contractor's NOTICE** of "Certificate of Substantial Completion".

END OF SECTION

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
2. Section 05 40 10 Metal Stud Framing (non-bearing) for blocking
3. Section 05 50 00 "Metal Fabrications" for miscellaneous steel attachment shapes.

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) (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 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

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 26 01 - CORNER GUARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Corner guards.

1.2 RELATED REQUIREMENTS

A. Section 05 41 00 Load-Bearing Metal Studs
B. Section 09 21 16 Gypsum Board Assemblies

1.3 REFERENCE STANDARDS

A. US Green Building Council (USGBC), LEED Certification Program www.usgbc.org.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.
B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
C. Samples: Submit two sections of corner guard, 24 inch long, illustrating component design, configuration, color and finish.
D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Corner Guards:
B. InPro Corporation; Product Stainless Steel Surface Mount Corner Guards: www.inprocorp.com.

C. Afco Brands; Product Lunar (CG-2143).
D. Substitutions: See Section 01 60 00 for requirements.

2.2 COMPONENTS

A. Corner Guards - Surface Mounted: Extruded one-piece unit without splices, installed with adhesive.
   1. Material: Type 304 stainless steel, NO.4 finish.
   2. Thickness: 16 gage, 0.06 inch.
   3. Width of Wings: 1-1/2 inches.
   4. Styles: Provide angled corners and wall end protectors to match wall angles.
   5. Adhesive if used shall comply with VOC limits as required in LEED EQ 4.1.
   6. Size: 1-1/2 inches.
   7. Length:
      a. Length: Full Height

B. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.
C. Attachment recommended by the manufacturer.

2.3 FABRICATION

A. Fabricate components with tight joints, corners and seams.
B. Pre-drill holes for attachment.
C. Form end trim closure by capping and finishing smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.
B. Position corner guard from top of wall base up to underside of ceiling.

3.2 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

END OF SECTION 10 26 01

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 F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written 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:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [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 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.

2.3 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:

1. [illegible]
2. [illegible]

C. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. [illegible]
2. [illegible]
3. [illegible]

D. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. [illegible]
2. [illegible]

E. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:

1. [illegible]

F. Valves in branch piping for single appliance shall be the following:

1. [illegible]

2.4 WATER PIPING AND FITTING MATERIALS

A. All water piping shall comply with NSF/ANSI Standard 372 for low lead requirements.

B. Above Grade: ASTM B88, Type L copper tubing, hard temper with wrought copper fittings.

C. Below Grade: ASTM B88, Type K copper tubing, hard temper with wrought copper fittings.

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.

2.5 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.

2.6 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]

2.7 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.

2.8 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.

2.9 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]

[illegible]

[illegible]

[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.

B. Paint exposed, interior metal piping, valves, service regulators, earthquake valves, and piping specialties except components, with factory-applied paint or protective coating.

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. Packaged Air Conditioner.
2. Condensing Units.
3. Split Systems.
4. Fans.
5. Roof Hoods and Caps.
6. Ductwork.
7. Duct Insulation and Lining.
8. Dampers and Duct Accessories.
9. Filters.
10. Diffusers, Registers, and Grilles.
11. Louvers.
12. Refrigerant Piping.
13. Mechanical Supports.
14. 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 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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 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.

3.12 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.

3.13 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.

3.14 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.

3.15 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.

3.16 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 50 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. Underground feeder and branch-circuit cable.
C. Service entrance cable.
D. Wiring connectors.
E. Electrical tape.
F. Heat shrink tubing.
G. Oxide inhibiting compound.
H. Wire pulling lubricant.
I. Cable ties.
J. 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.

T. UL 854 - Service-Entrance Cables; 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. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.
      c. 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 SERVICE ENTRANCE CABLE

A. Manufacturers:
1. Copper Service Entrance Cable:
    a. Cerro Wire LLC: www.cerrowire.com/#sle.
    b. Encore Wire Corporation: www.encorewire.com/#sle.
    c. Southwire Company: www.southwire.com/#sle.

B. Service Entrance Cable for Above-Ground Use: NFPA 70, Type SE multiple-conductor cable listed and labeled as complying with UL 854, Style R.

C. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.

D. Conductor Stranding: Stranded.

E. Insulation Voltage Rating: 600 V.

2.6 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.

2.7 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 materials and methods specified in Section 07 84 00.

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. 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 7.3.2. 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.

D. 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.
D. Ground bars.
E. Ground rod electrodes.
F. Ground plate electrodes.
G. Ground access wells.

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. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2017.
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 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.

B. Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.

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. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   4. Ground Rod Electrode(s):
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
      d. Provide ground access well for each electrode.
   5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

6. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
    b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
    c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

I. 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.

J. 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:

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Manufacturers:

F. Ground Plate Electrodes:
1. Material: Copper.
2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.

G. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".
5. 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. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree

angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

E. 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.

F. 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; see Section 03 30 00.

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.
G. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
H. Section 27 05 33.13 - Conduit for Communications Systems.

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. Electrical Service Conduits: See Section 26 21 00 for additional requirements.

C. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. 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.

G. 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; see Section 07 84 00.

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 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. 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.

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.

G. 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 01 45 33 - Code-Required Special Inspections and Procedures.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. 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 in accordance with Section 03 30 00.

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 in accordance with Section 03 30 00.

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 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 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

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 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

H. Section 26 27 13 - Electricity Metering: For interface with equipment specified in this section.

I. Section 26 43 00 - Surge Protective Devices.

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. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.

K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

L. 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.

M. 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 constructed in accordance with Section 03 30 00.

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.

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.

C. 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.

D. All wire and cable passing through metalwork shall be sleeved with an appropriate grommet or bushing.

E. 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.

F. 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.

G. 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 Splice Module	**Panduit**	**FOSMF**
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 15 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 2.01 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 31 00
INTRUSION DETECTION

PART I - GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable electronic Intrusion Detection system. The system shall provide intrusion alarm notification, monitoring, command and control and be connected to the District's existing UL listed monitoring station.

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 Intrusion Detection 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.

3. Intrusion detection equipment: Includes, but is not limited to:
   a. Control panels
   b. Keypads
   c. Motion detectors
   d. Door contacts
   e. Glass break detectors
   f. Monitor modules
   g. Wire

4. Typical installation includes central control panel and keypad with distributed motion detection and/or door contacts for rooms requiring intrusion detection.

5. All installations with network connectivity shall utilize District's network.

6. All control panels shall have battery backup.

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 Intrusion Detection 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.

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 communications 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 - 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. 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.

C. The control panel cabinet shall have a key lock.

D. The control panel cabinet shall have backup batteries.

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 intrusion detection 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. The Contractor shall submit and receive approval for submitted 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. All wiring in enclosure shall have 12" minimum service loop for troubleshooting/repairs.

C. All shielded wiring to have shields grounded at the upstream end only. Floating shields are strictly prohibited.

D. Data drops to be installed inside the controller panel cabinet.

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. Device ID Labels are to be 1/4" lettering for mounting heights 10' AFF or less, 1/2" black lettering on white labels for mounting heights greater than 10' AFF.

C. Intrusion Control Panel/Cabinet label – Panel ID on exterior top right of panel door.

D. Battery label – Install date.

E. Wiring label – Panel, ID-Zone/Circuit.

F. Network Information label – MAC and IP address on interior top right of panel door.

G. Network Cable Termination label - MDF/IDF-port number.

H. Zone schedule – A zone schedule and device location drawing shall be printed and installed in a plastic sleeve inside the panel cover door.

3.09 CONFIGURATION

A. Program all network equipment with network IP address information obtained from Technology Services.

B. 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, the Contractor shall perform a complete test and inspection of the system. If found to be installed and operating properly, the Contractor shall 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 riser diagram showing all components for project.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

END OF SECTION

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. 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 77 00 - Closeout Procedures.

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. 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. Verify site conditions.

B. 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 32 96 00 – Landscape Planting.
6. Section 33 30 00 – Sanitary Sewerage Utilities.
7. Section 33 40 00 – Storm Drainage Utilities.
8. Section 03 30 00 – Cast-in-Place Concrete.

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. Section 01 06 00 - Regulatory Requirements.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

C. 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 70 00 - Execution and Closeout Requirements.

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.
   4. Section 32 96 00 – Landscape Planting.
   5. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

A. The project Soils Report and any supplements to the Soils Report.

PART 2 - PRODUCTS

1.3 FILL MATERIALS

A. Fill and Structural Fill as specified in the Soils Report and any supplements to the Soils Report.

1.4 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven as manufactured by TC Mirafi, Tensar Earth Technologies, Inc. or equal.

PART 2 - EXECUTION

1.5 EXAMINATION

A. Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify structural ability of unsupported walls to support loads imposed by the fill.

1.6 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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1.7 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.

1.8 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.

1.9 FIELD QUALITY CONTROL

A. The project Soils Engineer shall provide testing and inspection services.

1.10 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements.

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. Coordination and project conditions.

B. 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 14 - SUBGRADE AND ROADBED

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes, but is not necessarily limited to the work necessary for the preparation of the subgrade.
   1. The subgrade will be considered as those areas and surfaces of new or existing streets, alleys, driveways, parking lots, sidewalks, or other places upon which additional materials are to be placed under Contract, or which are to be constructed or prepared for the future placement thereupon of other materials in accordance with Section 31 20 00 – Earth Moving, and as provided herein.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. All underground work contemplated in the area of the subgrade shall be completed and properly backfilled before subgrade work is started. This is intended to include work on the Contract, work to be performed by the School District, or by others.
B. These Specifications are to be used in conjunction with requirements in those sections of the Specifications having to do with specific types of base materials and pavements.
   1. Section 02 41 19 Selective Site Demolition
   2. Section 31 10 00 Site Clearing
   3. Section 31 20 00 Earth Moving
   4. Section 32 12 15 Aggregate Base
   5. Section 32 12 16 Asphalt Paving
   6. Section 32 13 13 Concrete Paving

PART 2 - PRODUCTS

2.01 EXCAVATION AND EMBANKMENT

A. The excavation shall include removal of materials which are encountered in excavating to the required grades, including existing pavement and curbs designated to be removed, or as required to accomplish the construction.

2.02 EQUIPMENT

A. Furnish all necessary equipment required to accomplish the excavating, shaping, grading and rolling, and compaction specified herein.

PART 3 - EXECUTION

3.01 SUBGRADE

A. Excavate and shape subgrade to line, grade, and cross section. Roll subgrade with an approved roller until the top 12 inches is compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 1557. Remove all soft or otherwise unsuitable material disclosed by the rolling and replace with suitable material from the excavation. Fill holes, and depressions which develop under the roller, to the required grade and cross sections with material from the excavation. The finished subgrade shall be within a tolerance of plus or minus 0.10 of a foot of the grade and cross section shown, shall be smooth and free from irregularities and at the specified density. Compaction shall extend one foot beyond the edge of paving, curb, or form work.

B. The Contractor shall be responsible for the protection of existing improvements; any damage resulting from his operations shall be the Contractor's sole responsibility.

3.02 EXCAVATION BELOW GRADE

A. Where the Geotechnical Engineer deems subgrade material to be unsatisfactory, excavation below grade will be required to such depths as necessary to remove the unsatisfactory material. Excavation below grade shall be of the same classification as that above it provided it is removed in the same operation as the normal excavation. Where the Contractor has completed the excavation and is required to remove additional, unsuitable material beyond the scope provided in these specifications, or where the additional depth requires special equipment because of unforeseen conditions, the work shall be performed and a payment for excavation below grade will be made on the basis of extra work as provided in the Contract.

B. If the excavation below grade is required because of negligence on the part of the Contractor, the necessary excavation below grade and the backfilling required to restore the surface satisfactorily shall be at the Contractor's sole expense.

C. The subgrade shall be sprinkled with water as required, and in such quantities as necessary, to obtain the specified compaction.

3.03 PROTECTION OF SUBGRADE

A. After preparing the subgrade as above specified, all unnecessary traffic shall be kept off. Should it be found necessary to haul over the prepared subgrade, the Contractor shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand-tamped. All

equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

B. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross section, will not be permitted. The Contractor shall protect the prepared subgrade from both construction and public traffic.

C. The subgrade shall be maintained in the finished condition until the first succeeding course is placed.

3.04 PLAY AREAS

A. Excavate and shape play area to the lines, grades, and cross sections shown, or as determined in the field by the Engineer.

END OF SECTION 32 12 14

SECTION 32 12 15 - AGGREGATE BASE

PART 1 - GENERAL

1.01SUMMARY

A. Section Includes: This section covers the materials and work necessary for construction of aggregate base, as specified, complete.
   1. Related Sections:
      a. See Division 1 – General Requirements, which contain information and the requirements that apply to the work specified herein.
         1) Section 321214 Subgrade and Roadbed.
         2) Section 321216 Asphalt Paving
         3) Section 321313 Concrete Paving

1.02 SUBMITTALS

A. Samples and Testing: At least thirty (30) days prior to the use thereof, the Contractor shall submit to the Geotechnical Engineer a sample of aggregate, graded as intended for use. Provide sample size as directed by the Geotechnical Engineer, not to exceed 120 lbs. This requirement shall be complied with for each aggregate and grading thereof that has not been reviewed. The Geotechnical Engineer will test the sample at no cost to the Contractor, and will determine the acceptability of the aggregate.

B. Alternate: Certified copies of aggregate test results from an independent testing laboratory shall be furnished to the Engineer for review at least one week prior to delivery of aggregate to the site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aggregate: The aggregate shall be free from vegetable matter and other deleterious substances. Aggregate for aggregate base shall consist of material of which at least 60 percent by weight shall be crushed particles as determined by Test Method No. Calif. 205.
   1. The percentage composition by weight of aggregate base shall conform to one of the following gradings when determined by Test Method No. Calif. 202.
   2. The particle size distribution shall be in accordance with the grading specified for 3/4-inch maximum size aggregate.

	Percentage Passing	
Sieve Size	1-1/2" Maximum	3/4" Maximum
2-Inch	100	
1-1/2-Inch	90-100	
1-Inch		100
3/4-Inch	50-85	90-100
No. 4	25-45	35-60
No. 30	10-25	10-30
No. 200	2-9	2-9

3. The aggregate base shall also conform to the following quality requirements:

	Test Method	
Tests	No. Calif.	Requirements
Resistance (R-Value)	301	78 Minimum
Sand Equivalent	217	30 Minimum
Durability Index	229	35 Minimum

4. The aggregate shall not be treated with lime, cement, or other chemicals before the Durability Index test is performed.
5. Material yielding a maximum dry density of less than 112 pounds per cubic foot when tested in the laboratory in accordance with ASTM "Standard Methods of Test of Moisture-Density Relations of Soils, Using 10-Pound Rammer and 18-Inch Drop", Designation D 1557, shall not be used.
6. Any rock, including red rock, meeting all the requirements of this Section will be acceptable. Such rock shall be plant processed at an approved processing plant.

2.02 EQUIPMENT

A. Furnish all necessary equipment required to accomplish the spreading, shaping, and compaction required.

PART 3 - EXECUTION

3.01 SUBGRADE

A. Proof roll subgrade immediately prior to commencement of spreading of aggregate base. Make necessary repairs as directed by the Geotechnical Engineer OR as described in Section 321214 – Subgrade and Roadbed.

3.02 DELIVERY AND SPREADING

A. Aggregate base material shall be delivered to the roadbed as uniform mixtures; each layer shall be spread in one operation.
B. At the time aggregate base is spread it shall have a moisture content sufficient to obtain the required compaction. Such moisture shall be uniformly distributed throughout the material.
C. The material shall be spread upon the prepared subgrade by means of vehicles equipped with approved spreading devices at a uniform quantity per linear foot, which quantity will provide the required compacted thickness within the tolerances specified.
D. Depositing and spreading shall commence at that part of the work farthest from the supply of base material and shall progress continuously without breaks, unless otherwise directed by the Geotechnical Engineer.
E. Where the required thickness is six inches or less, the base material may be spread and compacted in one layer. Where the required thickness is more than six inches, the base material shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed six inches. Each layer shall be spread and compacted in a similar manner.
F. Base material placed in areas inaccessible to the spreading equipment may be spread in one or more layers by any means that will make possible the specified compaction and surface.
G. When the subgrade for aggregate base consists of cohesionless sand, and written permission is granted by the Geotechnical Engineer, the base material may be dumped in piles upon the subgrade and spread ahead from the dumped material.
H. The base material, after spreading, shall be shaped by means of a blade grader to such thickness that after watering and compacting, the completed base will conform to the required grade and cross section within the tolerances specified.
I. Segregation of aggregate shall be avoided; the base shall be free from pockets of coarse or fine material.

3.03 COMPACTION

A. Immediately following spreading, shaping, and smoothing, the full width of the base material shall be watered as ordered by the Geotechnical Engineer, and compacted by rolling with a minimum of two pieces of self-propelled reversible equipment. Compaction shall be as follows:
    1. For initial rolling use a 3-wheel steel-tired roller, weighing not less than 12 tons distributed so that the rear wheels will apply to the surface being rolled not less

than 325 pounds per linear inch of rear tire width. Rolling shall commence by covering completely the outer edge of the material. Subsequent passes shall lap at least 25 percent on previously rolled material.

2. For subsequent rolling use a pneumatic-tired roller of the oscillating type, having a width of not less than four feet and equipped with tires of equal size and diameter. Wobble wheel rollers will not be permitted. The tires shall be so spaced that the entire gap between adjacent tires will be covered by the tread of the following tire. The tires shall be inflated to 90 pounds per square inch minimum.
3. To compact all areas inaccessible to the rollers, use compressed air or gas powered tampers.

B. The foregoing equipment requirements serve as a standard of adequacy.

C. Subject to the condition that the Contractor shall notify the Geotechnical Engineer at least ten (10) days in advance and shall secure approval for the use of each piece of compacting equipment other than that specified, selection thereof and obtainment of the specified compaction throughout the volume of base and the specified surface shall be solely the responsibility of the Contractor.

D. If compaction is not uniform or tests show it to be inadequate, or if the surface is unsatisfactory, the Geotechnical Engineer may require the use of other or additional equipment.

E. Should low or high spots develop during rolling operations, such spots shall be smoothed by blading with a self-propelled, pneumatic-tired motor grader having a wheelbase not less than 15 feet long and a blade not less than 10 feet long.

F. Aggregate base shall be watered after compaction. Water shall be applied at the rate and in the quantities ordered by the Geotechnical Engineer.

G. The relative compaction of aggregate base, determined by tests of the in-place, field compacted base shall be not less than 95 percent of the maximum compaction at optimum moisture content determined by ASTM Methods of Test, Designation D 1556 and Method C of Designation D 1557. The tests will be conducted and evaluated in the laboratory by the Geotechnical Engineer at no cost to the Contractor.

H. The surface of the finished aggregate base at any point shall not vary more than 0.05 foot above or below proper grade; such surface shall contain no ridges, valleys or sharp breaks.

I. Finished base that does not conform to the foregoing requirements shall be reshaped or reworked, watered, and thoroughly recompacted to conform thereto.

J. The Contractor shall not allow any completed untreated rock base to be subject to public or construction traffic, except the latter necessary to the completion of the overlying surface courses.

END OF SECTION 32 12 15

SECTION 32 12 16 - ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01SUMMARY

A. Section Includes: This section covers the work necessary for construction of the asphalt concrete leveling course and surface course used for paving roadways and parking areas, and the repair and replacement of existing pavement that has been disturbed by trenching or other construction.

B. Related Sections:
   1. See Division 1 - General Requirements, which contain information and requirements that apply to the work specified herein.

1.02 SUBMITTALS

A. Submittals during construction shall be made in accordance with Division 1, General Requirements.

B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section;
   2. Certificates, signed by the materials producer and the asphalt paving subcontractor, stating that materials meet or exceed the specified requirements.

1.03 QUALITY ASSURANCE

A. Standards: The following shall form a part of this specification and shall have the same force as if reproduced in total herein:
   1. Standard Specifications.
   2. Materials Manual of Testing and Control Procedures, State of California, Business and Transportation Agency, Department of Transportation, herein after referred to as "Materials Manual".
   3. ASTM D 1577 shall be used for the method of performing compaction tests.

PART 2 - PRODUCTS

2.01 ASPHALT

A. Asphalt concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant.
   1. Asphalt concrete shall be as required by jurisdiction.
   2. Grade of asphalt shall be PG 64-10.
   3. Density shall be 95% of maximum laboratory density as determined by California Test Method 304.
   4. Stability shall be 30 minimum.
   5. Mineral aggregate shall be Type B, ½" maximum size aggregate, medium grading, and shall conform to the following requirements:
      a. The particle size distribution shall be in accordance with the grading specified for 1/2-inch maximum size aggregate.

Sieve Size	Maximum Percentage Passing
3/4-Inch	100
1/2-Inch	95-100
3/8-Inch	80-85
No. 4	54-64
No. 8	38-48
No. 30	20-30
No. 200	3- 8

   6. Drying, proportioning and mixing of the materials shall conform to Section 39 of the Standard Specifications.

B. Slurry Seal Coat shall be a Type II slurry seal and shall be a one coat process, or approved equivalent. The manufacturer shall supply the product in sealed containers, or provide certification of manufacturer to the Engineer.

C. Seal Coat shall be equal to SS1H one coat process, or approved equivalent. The manufacturer shall supply the product in sealed containers, or provide certification of manufacturer to the Engineer.

2.02 AGGREGATE

A. Aggregate base shall conform to the provisions of Section 321215 Aggregate Base and as provided herein.
   1. The grading of the aggregate shall be "1/2 - inch Maximum, Medium" as described hereon, except in conform or overlay areas, the grading shall be 3/8 - inch maximum.

B. Sampling and testing will not be required. The Contractor shall provide test results as indicated in this section.

2.03 COMPOSITION OF MIXTURE

A. At least thirty (30) days prior to producing any of the mixture for use in the paving, the Contractor shall submit to the Engineer for approval a job - mix formula which meets the requirements herein specified. No asphalt pavement work shall be undertaken by the Contractor until the Engineer has reviewed the job - mix formula.
B. The Contractor shall be responsible for locating an acceptable source of aggregate. All tests confirming the suitability of the material for the purpose intended shall be obtained by the Contractor at the Contractor's expense. Certified copies of the aggregate test results from an independent testing laboratory shall be furnished to the Engineer for review at least one week prior to delivery of aggregate to the site or use of aggregate in asphalt concrete.
C. The Contractor shall make arrangement and pay for preparation of the asphalt concrete job mix formula. The job - mix formula for the asphalt concrete mixture shall establish the percentage of aggregate passing each sieve size, and the percentage of bituminous material to be added to said aggregate, and the temperature at which test results from a qualified, independent testing laboratory confirming the job - mix formula shall be submitted by the Contractor to the Engineer for review at least two weeks prior to the start of asphalt concrete paving. Any proposed deviations from the original job - mix formula shall be resubmitted by the Contractor for review. Test results of aggregate used in asphalt shall be provided as indicated in this section.
D. The job – mix formula shall indicate the gradation of each of the several aggregate constituents to be used in the mixture and shall establish the exact proportion of each constituent to be used to produce a combined gradation of aggregate within the appropriate limits stated above.
E. After a job - mix formula is established and reviewed, all mixtures furnished under this Contract shall be conform to the requirements and tolerances as stated in these Specifications.

2.04 WEED CONTROL

A. Spray applied herbicide, currently approved for designated use by all applicable agencies, including air pollution control jurisdiction.

PART 3 - EXECUTION

3.01 PREPARATION OF ROADWAY

A. Subgrade shall be fine graded per Section 02300 Earthwork and Section 02335 Subgrade and Roadbed. The finished subgrade shall be tested and approved by the Geotechnical Engineer prior to the placement of aggregate base.
B. Thoroughly blend base course aggregate on the job site. Construction shall conform to applicable portions of Section 26 of Standard Specifications. Base material shall be placed, watered as required and mechanically compacted until a relative compaction of 95% has been obtained for the entire thickness of the base. Each layer of base course shall be tested and approved by the testing laboratory prior to the placement of successive layers. Compacted base thickness shall be as indicated on the drawings.
C. Apply herbicide chemical to all areas to receive paving in strict accordance with the printed instructions of the manufacturer. Take all necessary safety precautions to protect against damage or injury due to its poisonous nature. No weed-control chemical is to be applied to areas designated for planting.
D. A tack coat of asphalt applied at the rate of 0.05 to 0.12 gallons per square yard shall be applied uniformly to all surfaces on which any course of asphalt concrete is to be placed.
E. The tack coat shall be emulsified asphalt. The emulsified asphalt may be mixed with water at the rate of 1 to 2 parts water to 1 parts water to 1 part of emulsified asphalt.
    1) Preparation of Untreated Roadway
    2. A prime coat shall be applied over the full length of the project, and asphalt concrete pavement shall not be placed until the prime coat has cured.
    3. Should any holes, breaks, or irregularities develop in the roadway surface after the prime coat has been applied, they shall be patched with asphalt concrete immediately in advance of placing the asphalt concrete. The Contractor shall maintain the completed prime coat by blading or brooming with motor patrol graders, until the asphalt concrete is placed.
    4. After the maintenance, patching or repair work has been completed and immediately prior to placing the asphalt concrete pavement, the surface of the prime coat shall be swept clean of all dirt, dust or other foreign matter.

3.02 ASPHALT CONCRETE PAVEMENT

A. The proportioning and mixing of asphalt concrete shall conform to the provisions provided herein. The pounds of asphalt per 100 pounds of dry aggregates shall not vary by more than 5% above or 10% below the amount indicated in the job - mix formula. This requirement shall apply to samples taken from a single batch, successive

batches, at different locations in the production plant, or at any location on the construction site.

B. Paint binder shall be applied in conformance with the provisions provided herein.

C. Spreading equipment and methods shall conform to the provisions provided herein. No asphalt concrete shall be placed on any section of compacted aggregate base that has not been reviewed by the Geotechnical Engineer.

D. The asphalt concrete shall be compacted in accordance with the provisions provided herein. The weight and pressure of the Contractor's pneumatic tired roller will be reviewed, but not designated or approved, by the Geotechnical Engineer.

E. Confirm areas associated with placement of asphalt concrete conform to the provisions provided herein.

3.03 PLACEMENT OF ASPHALT CONCRETE PAVING

A. Install the specified curbs, and headers and stakes, to achieve the arrangement of paving shown on the drawings. All unconfined edges shall be confined with 2 inch by 4 inch redwood header boards staked with a 1 inch by 3 inch redwood stake 18 inches long minimum at 6 feet on-center. Two 1 inch by 4 inch pieces may installed together for bending along curves. Offset all joints by 2 feet.

B. Remove all loose materials from the compacted base.

C. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations as approved by the Engineer.

D. Asphalt paving shall be installed in minimum lifts of 1.5 inches.

E. Adjust frames, covers and utility vaults, if so required, to meet final grades.

F. Do not accept receipt of asphalt concrete material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280°F.

3.04 CONNECTIONS WITH EXISTING FACILITIES

A. Where it is necessary to remove existing asphalt surfaces or oil mat surfaces to provide proper meet lines and riding surfaces, the Contractor shall burn or chip the existing surface so that there will be sufficient depth to provide a minimum of one inch of asphalt concrete, and the waste material shall be disposed of to the satisfaction of the Engineer and Federal, State and Local Ordinances. Prior to placing the asphalt concrete these areas shall be tacked. Meet lines shall be straight and the edges vertical. The edges of meet lines cuts shall be painted with liquid asphalt or emulsified asphalt prior to placing asphalt concrete. After placing the asphalt concrete, the meet line shall be

sealed by painting with a liquid asphalt or emulsified asphalt and immediately covered with clean, dry sand.

B. Prior to laying the second strip of asphalt concrete pavement, the edge of the first strip laid and other contact surfaces such as curbs, manhole frames, and similar materials shall be painted with emulsified asphalt or liquid asphalt to provide closely bonded watertight joints. This work shall be done in a manner that will prevent staining adjacent surfaces not intended to be coated.

3.05 COMPACTION

A. Rolling shall continue until all roller marks are eliminated and a minimum density of 140 pcf has been obtained.
B. Field density tests shall be made by a commercial testing laboratory retained by the Owner, and the test results submitted to the Geotechnical Engineer for review.

3.06 JOINTS

A. The placing of the top or wearing course shall be as nearly continuous as possible, and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued for such length of time as to permit the mixture to become chilled.
B. When the work is resumed the previously compacted mixture shall be cut back to produce a slightly beveled edge of the full thickness of the course. The material which is cut away shall be wasted and new mix shall be laid against the fresh cut. Rollers or tamping irons shall be used to seal the joints.

3.07 SURFACE TOLERANCE

A. Tests for Conformity with the specified crown and grade shall be made by the Contractor immediately after initial compression. Any variation shall be immediately corrected by the removal or addition of materials and by continuous rolling.
B. The completed surface of the top of wearing course shall be of uniform texture, smooth, uniform as to crown and grade and free from defects of all kinds. The completed surface shall not vary more than 1/8 inch from the lower edge of a 10 foot straight edge placed on the surface parallel to the centerline.
C. After completion of the final rolling, the smoothness and grade of the surface shall again be tested by the Contractor.
D. When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by the addition of asphalt concrete mixture of an appropriate class to

low places or the removal of material from high places by methods satisfactory to the Engineer, or by removal and replacement of the wearing course of asphalt concrete. Correction of defects shall be carried out until there are not deviations anywhere greater than the allowable tolerances.

E. All areas in which the surface of the completed pavement deviates more than twice the allowable tolerances described above shall be removed and replaced to the satisfaction of the Engineer.

F. All costs involved in making the corrections of defects described above shall be borne by the Contractor and no compensation will be made for this work.

3.08 APPLICATION OF SEAL OR SLURRY COAT

A. Areas that have received new AC shall have a minimum 30 day cure time prior to application of either seal or slurry coat. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Geotechnical Engineer.

B. Apply one coat of the specified sealer.

C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

3.09 SAMPLES

A. The contractor shall, without additional charge, provide the Geotechnical Engineer with test results of samples of asphalt concrete cut from the completed pavement or the individual courses thereof. The minimum number of test cores shall be two per day during paving. The number of cores shall be increased if problems are indicated. The contractor shall also provide the Geotechnical Engineer with test results or samples of the uncompressed asphalt concrete mixtures, and all materials incorporated in the work.

3.10 UNFAVORABLE WEATHER

A. Asphalt for prime coat shall not be applied when the ground temperature is lower than 50 degrees F without written permission of the Geotechnical Engineer.

B. Asphalt concrete shall not be placed when the atmospheric temperature is less than 40 degrees F nor during heavy rainfall.

3.11 ALLOWABLE TOLERANCES

A. Surface Smoothness:
   1. The surface of the finished base course shall not vary more than 3/8 inch, plus or minus, in 10 feet.
   2. The surface of the finished asphalt concrete shall not vary more than ¼ inch, plus or minus, in 10 feet.

B. The compacted paving or base course thickness shall not vary more than ¼ inch, plus or minus, based on an average of five (5) measurements per 10,000 square feet, taken at randomly selected locations by testing laboratory.

C. Provide hot plant mixed asphalt concrete paving materials:
   1. Temperature leaving the plant shall be 290 degrees Fahrenheit minimum, 320 degrees Fahrenheit maximum.
   2. Temperature at time of placing shall be 280 degrees Fahrenheit minimum.

3.12 SURFACE FINISH

A. Surface finish shall be uniform and consistent in color and texture throughout the extents of the project and shall be achieved, at a minimum, by applying a slurry coat.

END OF SECTION 32 12 16

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.
5. Section 33 49 13 - Storm Drainage Manholes, Frames, and Covers.

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 63 10 - 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 Control: 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 06 00 - Administrative Requirements: 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.

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 Requirements: Testing and inspection services
Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: 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 12 36 - SLURRY SEAL EXISTING ASPHALT PLAYGROUND

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions – Division 0 Specification Sections, apply to this Section.

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:
1. Use locally available materials and gradations which exhibit a satisfactory record of previous installations.
2. OverKote products are available through Reed & Graham, Inc. (408) 287-1400.

B. OverKote Asphalt Pavement Coating: as manufactured by Reed & Graham, Inc. or approved equal. conforming to the following:

a.	Residue at 300 to 400 degrees F	55-65
b.	Dehydration, 96 hours at 100 degrees F	0.6 min
c.	Solubility of residue in C2HCL	15-20
d.	Loss on ignition of insoluble reside %	16 max
e.	Cone penetration at 77 degrees F	dmm 400-700

C. OverKote Crackfiller I: as manufactured by Reed & Graham, Inc. or approved equal for 1/8" to ¼" width and smaller cracks.

D. OverKote Crackfiller II: as manufactured by Reed & Graham, Inc. or approved equal for 1/4" to 1/2" width cracks.

E. OverKote Oil Spot Sealer: as manufactured by Reed & Graham, Inc. or approved equal.

F. 30 Mesh Sand.

G. Game Line Paint: White, unless noted otherwise on the plans, water based, 100% acrylic, lead free striping and marking materials manufactured for permanent, exterior game line marking.

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 I for up to ¼" and OverKote Crackfiller II for up to ½". 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 GAME LINE PAINT AND PARKING STRIPING:

A. Game Line Paint:
   1. Cleaning: Sweep and clean surface to eliminate loose material and dust.
   2. Color: White, unless noted otherwise on drawings and details.
   3. Do not apply game line paint until layout and placement has been verified with Architect.
   4. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommended rates.
   5. Return all stencils to the district.

3.4 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 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including admixtures.
B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
C. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.
D. All finished surfaces shall be “slip-resistant” per requirements outlines in the Cal Trans Standard Specifications Section 40-1.10 Final Finishing.
E. The Contractor shall have one copy of the Standard Specifications at the job site.
F. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement: ASTM C 150, Type II, low alkali. Supplement with the following:
      a. Pozzolan: ASTM C618, Class F or N Fly Ash, 100 pounds maximum per cubic yard, containing one percent or less carbon. Fly ash shall not be used in excess of 15 percent by weight of total cement quantity.

B. Combined Aggregates: Gradation "C" conforming to SSPWC Section 201-1.3.2.
C. Water: ASTM C 94/C 94M.

2.3 CURING MATERIALS

A. Liquid Curing Compound: ASTM C309, fugitive dye dissipating type, complying with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254.
B. Moisture-Retaining Cover (Curing Sheet): ASTM C 171, non-staining polyethylene film or white burlap-polyethylene sheet.
C. Water: Potable.
D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

2.4 RELATED MATERIALS

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

B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

D. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.

1. Color: Per Architect

2.5 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized.
1. Dowels: Galvanized steel, three-fourths-inch diameter, 24-inch minimum length.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
1. Compressive Strength (28 Days): 2,500 pounds per square inch (psi)
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.60.
3. Slump Limit: Four inches, plus or minus one inch.

B. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates to Architect for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

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

3.4 JOINTS

A. General: Form construction, isolation, and control joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
D. Control Joints: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a one-fourth-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
D. Screed pavement surfaces with a straightedge and strike off.
E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.
B. General: Slopes less than 6% shall have equal or better than medium salted finish. Slopes greater than 6% shall be slop resistant.
C. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
    1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
    2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
    3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface one-sixteenth to one-eighth inch deep with a stiff-bristled broom, perpendicular to line of traffic.

D. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.
   1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
   2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
B. Comply with ACI 306.1 for cold-weather protection.
C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds/square feet x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances as follows
   1. Elevation: One-fourth inch.
   2. Thickness: Plus three-eighths inch minus one-fourth inch.
   3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed one-fourth inch.
   4. Joint Spacing: Three inches.
   5. Contraction Joint Depth: Plus one-fourth inch no minus.
   6. Joint Width: Plus one-eighth inch, no minus.

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
C. Sweep and clean surface to eliminate loose material and dust.
D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel one inch beneath top of wheel stop.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

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SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete sidewalks, integral curbs, gutters, parking areas, driveways, and roads, and aggregate base course.

B. Related Sections:
1. Section 31 22 13 - Rough Grading.
2. Section 31 23 23.13 - Backfill.
3. Section 32 11 23 - Aggregate Base Course.
4. Section 32 96 00 – Landscape Planting.
5. Section 33 49 13 - Storm Drainage Manholes, Frames, and Covers.

1.2 REFERENCES

A. ACI 304 (American Concrete Institute) - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

B. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

C. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

D. ASTM A615 - DeformeM and Plain Billet-Steel for Concrete Reinforcement.

E. ASTM C33 - Concrete Aggregates.

F. ASTM C94 - Ready Mix Concrete.

G. ASTM C150 - Portland Cement

H. ASTM C260 - Air-Entraining Admixtures for Concrete.

I. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

J. ASTM C494 - Chemical Admixtures for Concrete.

K. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

L. ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with requirements of Local Municipality.

B. Maintain one copy of each document on site.

C. Obtain cementitious materials from same source throughout.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not place concrete when base surface temperature is less than 40 degrees, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Wood or Steel form material, profiled to suit conditions.

B. Joint Filler: ASTM D1751.

2.2 REINFORCEMENT

A. Reinforcing Steel: ASTM A615; Grade 60 deformed billet steel bars; unfinished.

B. Welded Steel Wire Fabric: Plain type, ASTM A185 in flat sheets or coiled rolls; unfinished.

C. Dowels: ASTM A615; plain steel, unfinished.

2.3 CONCRETE MATERIALS

A. Concrete Materials: As specified in Section 03 30 00. Provide in accordance with local municipality Public Work's standards.

B. Fly Ash content per local Municipality Public Work's Standards.

2.4 CONCRETE MIX - BY PERFORMANCE CRITERIA

A. Provide concrete to the following criteria:
1. Compressive Strength: 3000 psi @ 28 days.

PART3 - EXECUTION

3.1 EXAMINATION

A. Coordination and project conditions.

B. Verify compacted subgrade or granular base is acceptable 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

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

A. Place reinforcement as indicated on drawings.

B. Interrupt reinforcement at expansion joints.

C. Place reinforcement to achieve pavement and curb alignment as detailed.

3.6 PLACING CONCRETE

A. Place concrete in accordance with local municipality Public Work's standards.

B. Ensure reinforcement, inserts, embedded parts, formed joints and are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints.

D. Place concrete to pattern indicated on drawings.

3.7 JOINTS

A. Place expansion and contraction joints as shown on drawings. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement.

C. Provide scored sawn joints as indicated on drawings and between sidewalks and curbs.

3.8 EXPOSED AGGREGATE

A. See Landscape Drawings and Specifications.

3.9 FINISHING

A. Sidewalk Paving: Light broom perpendicular to path of travel and trowel joint edges.

B. Curbs and Gutters: Light broom in direction of flow.

C. Direction of Texturing: Transverse to pavement direction.

D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

E. Place curing compound on exposed concrete surfaces immediately after finishing.

3.10 JOINT SEALING

A. Separate pavement from vertical surfaces with thick joint filler.

B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

C. Extend joint filler from bottom of pavement to within 1/8 inch of finished surface. Conform to joint sealer manufacturer requirements.

3.11 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.

C. Maximum Variation From True Position: 1/2 inch.

3.12 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services
Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Testing firm will take cylinders and perform slump [and air entrainment] tests in accordance with ACI 301.

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

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

3.13 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for 7days minimum after

finishing.

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 Federal Standard 595B, except for locations at curb ramps, islands, or cut-through medians where color used shall contract visually with that of adjacent walking surfaces, either light-on-dark, or dark-on-light. CBC Sections 11B-705.1.1.3 and 11B-705.1.1.5.

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 per DSA Bulletin 10/31/02, revised 04/09/08.

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 inch at base tapering to 0.45 inch 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

32 18 16 - PLAYGROUND RESILIENT SURFACING

PART I - GENERAL

1.1 SECTION INCLUDES

A. Resilient, poured-in-place, playground safety surfacing.

1.2 RELATED SECTIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions of
B. Division 1 Specification Sections, apply to this Section.
C. Section 32 12 00 - Asphalt Paving: asphalt concrete subsurface
D. Section 32 16 00 - Site Concrete: Concrete subsurface and curbs

1.3 REFERENCES

A. ASTM C 1028 Standard Test Method for Determining the Static Coefficient of friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
B. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers -
C. Tension.
D. ASTM O 624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and
E. Thermoplastic Elastomers.
F. ASTM D 2B59 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
G. ASTM E3O3 Standard Test Method for Measuring Surface Frictional Properties using the British
H. Pendulum Tester
I. ASTM F1292 - Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
J. ASTM F1951 Standard Specification for Determination Df Accessibility of Surface Systems under
K. and around Playground Equipment
L. ASTM F2479- 12 Standard Specification for Purchase, Installation and Maintenance
    1. US Consumer Product Safety Commission (CPSC) Handbook for Playground Safety.

1.4 PERFORMANCE REQUIREMENTS

A. Area Safety: Poured in place within playground equipment use zones shall meet or exceed the performance requirements of the CPSC, ADA, 2022 CBC requirements and Fall Height Test ASTM F1292 13. The surface must yield both a peak deceleration of no more than 200 G-max and a Head Injury Criteria (HIC) value of no more than 1,000 for a head-first fall from the highest accessible portion of play equipment being installed as shown on drawings. IPEMA certification is required. (ASTM F1292 Sf3CtiON 4.3.3: The Laboratory test used to determine critical fall height shall have been conducted on surfacing material samples identical in design, matf3rials, components, and thickness and manufactured as the installed playground surface).

B. Accessibility: Children's outdoor play areas shall be in compliance with all applicable accessibility standards, including but not limited to:
   1. Uniform Federal Accessibility Standards (UFAS] FED-STD-795 and the Architectural and Engineer Instructions (9AEI) Design Criteria.
   2. Americans with Disabilities Act Accessibility Guidelines (ADAAC) 28 CFR Part 36
   3. 2022 CBC chapter 11B, including Divisions 2 and 10.

C. Poured in place surfaces intended to serve as accessible paths of travel for persons with disabilities shall be firm, stable, slip resistant, and shall meet the requirements of ASTM F1951-14 and ASTM F12S2-13.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data and installation instructions.

C. Samples: Submit manufacturer's standard verification samples of 9" x 9" (229 x 229 mm) of playground safety surfacing showing texture, color, and thickness.

D. Test Reports: Submit certified test reports from qualified independent testing agency indicating results of impact attenuation testing.

E. Certificate of Compliance: Submit manufacturer's certificate of Compliance indicating materials comply with specified requirements.
   1. A signed statement by an authorized official certifying that the surfacing system melts the requirements of ASTM F1292-13 for a head-first fall from the highest accessible' portion of the specified playground equipment.

F. Manufacturer's Project References: Submit list of successfully completed projects. Include project name and location, name of architect, and type and quantity of playground safety surfacing furnished.

G. Installer's Project References: Submit list of successfully completed projects. Include project name and location name of Architect, and type and quantity of playground safety surfacing installed.
   1. A signed statement from the manufacturer of the poured in place surfacing attesting that all materials under this section shall be installed only by the Manufacturer's Trained Installers.
H. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.
I. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications' Manufacturer shall meet a minimum of 1 of the following 2 requirements:
   1. Continuously engaged in manufacturing of playground safety surfacing of similar type to that specified, with a minimum of 10 years successful experience.
   2. Furnished a minimum of 100,000 square feet of playground safety surfacing of similar type to that specified.
   3. IPEMA Certification mandatory.
B. Installer's Qualifications:
   1. Successful experience in installation of playground safety surfacing of similar type to that specified, with a minimum of 20 projects completed within last 5 years.
   2. Employ persons trained for installation of playground safety surfacing.
   3. Approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Storage
   1. Store materials in accordance with manufacturer's instructions
   2. Store materials in a dry area at a minimum temperature of 50 degrees F (10 degrees C) for a minimum of 72 hours before installation.
C. Handling: Protect materials during handling and installation to prevent damage or contamination.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Poured in Place surfacing must be installed on a dry subsurface, with no prospect of rain

within the initial drying period, and within the recommended temperature range of the manufacturer. Installation in weather conditions of extreme heat, cold (less than 55 degrees F), and/or high humidity may affect cure time and the structural integrity of the final product. Immediate surrounding sites must be reasonably free of dust conditions, or this could affect the final surface look. The manufacturer's Service Center Manager reserves the right to control the installation based on such factors without penalty to Manufacturer.

1.9 WARRANTY

A. Materials and Workmanship: Playground safety surfacing installation shall be warranted for defects in materials and workmanship for 5 years from date of completed installation.

B. General and Product Liability: not less than $1,000,000 for each occurrence, $2,000,000 general aggregate, with an Excess/umbrella liability of $2,000,000. The issuing underwriter shall be AA rated.

PART II - PRODUCTS

2.1 MANUFACTURER

A. This is the Basis of Design: Playbound Poured-In-Place by Surface America, Inc. PO Box 157 Williamsville, NY 14231. Phone: 800-999-0555 or 716-632-8413, FAX 716-632-8324. www.surfaceamerica.com

B. Or approved equal

2.2 POURED IN PLACE PLAYGROUND TURF SURFACING

A. The poured in place surface shall consist of a 2-layer system consisting of a basemat of 100% post-consumer recycled SBR (Styrene Butadiene Rubber) and polyurethane and top surface consisting of recycled post-industrial EPDM (Ethylene Propylene Diene Monomer).

B. It shall consist of a uniform material manufactured in such a way that the top portion meets the requirements specified herein for wear surface.

C. Cushion Layer Section:

1. Impact Attenuating Cushion Layer: Cushion Layer consists of shredded styrene butadiene rubber (SBR) and/or cryogenic crumb rubber adhered with a 100% percent solids polyurethane binder to form a resilient porous material.
2. Strands of SBR may vary from 0.5 mm - 2.0 mm in thickness by 3.0 mm - 20 mm in length. Cushion material may have a 50% SBR Cryogenic Crumb Rubber and a fiber content of 0.1% or less mixed in.
3. Foam or standard rubber granules are not to be permitted in a Cushion Layer.

4. Binder shall be between 8-12 percent of the total weight of the material and shall provide 100 percent coating of the particles.
5. The Cushion Layer shall be compatible with the Wear Course and must meet the requirements herein for impact attenuation.

D. Wear Course
1. Ethylene Propylene Diene Monomer (EPDM), Styrene Butadiene Rubber (SBR) granules with polyurethane binder formulated to produce an even, uniform seamless surface up to 2,000 square feet.
2. PDM shall be peroxide cured with an EPDM content of 26% percent and shall include a Processing aid to prevent hardness with 26% poly content to maintain dynamic testing characteristics, weatherization, and UV stability.
3. ASTM D 2240 (shore A) hardness of 55-65, not less than 26% percent rubber hydrocarbons.
4. Size of EPDM granules shall be 2-4 mm across. Binder shall be not less than 20% percent of total weight of rubber used in the wear surface and shall provide 100 percent coating of the particles.
5. Size of SBR granules shall be 1-3 mm across. Binder shall be not less than 20 percent of total weight of rubber used in the wear surface and shall provide 100 percent coating of the particles.
6. Thickness of Wear Course shall be a minimum of ½" inch (12.7 mm).
7. The Wear Course shall be porous.
8. The poured in place surface should be installed between the temperatures of 55°F to 90°F, and there should not be a fluctuation greater than 30 DegF during the installation or curing time.

E. Binder
1. No Toluene Diphenyl Isocyanate (TDI) shall be used. Aliphatic urethanes are to be used.
2. No filler materials shall be used in urethane such as plasticizers, and the catalyzing agent shall contain no heavy metals.
3. Weight of polyurethane shall be no less than 8.5 lbs/gal (1.02 Kg/l) and no more than 9.5lbs/gal (1.14 Kg/l).
4. Manufacturer is permitted to modify the type of urethane required to match extreme weather conditions. Substitutions must be equal to or exceed original quality.

PART III - EXECUTIONEXAMINATION

A. Examine areas to receive playground safety surfacing. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.
B. Verify that finished elevations or adjacent areas are as indicated on the architectural or

site plans, that the appropriate sub-grade elevation has been established for the particular safety surface to be installed, and that the subsurface has been installed per architectural, site or equipment plans while meeting accessibility and use zones requirements.

3.2 PREPARATION

A. Prepare subsurface in accordance with manufacturer's instructions to ensure proper support and drainage for playground safety surfacing. Due to the porosity of the playground safety surfacing, it is important that a proper subsurface drainage system be constructed.

B. Aggregate Sub Base: Tolerance of aggregate sub base shall be within 3/8" inch (10 mm) in 10’ ft (3050 mm). Verify that aggregate subbase has been fully compacted. Per ADA Guidelines: compacted Aggregate sub base - 4" inches min of Class 2 AB compacted to 95% percent in 2” inch watered lifts.

C. Concrete Sub Base: Tolerance of concrete or bituminous sub base shall be within 1/8" inch (3.0 mm) in 10’ feet (3050 mm). Per ADA Guidelines: Concrete a minimum of 3"- 4” inches at a minimum 2,500 PSI. Concrete must cure for 7 days prior to application of cushion layer. If Poured in Place surfacing is installed, verify that the Concrete Sub Base has cured (all areas appear white in color usually at 7 days) and that all concrete curing compounds and other deleterious substances that might adversely affect adhesion have been removed. Surface shall be clean and dry.

D. Asphalt Sub Base: Asphalt cure time requires 14 days. Once the new asphalt has cured, it must be pressure washed prior to the surfacing being installed. The contractor shall be responsible for flooding the pad to ensure proper slope and tolerances Any areas holding enough water to cover a flat nickel shall be patched.

E. Drainage: Verify that sub-surfacing drainage, if required, has been installed to provide positive drainage.

3.3 INSTALLATION

A. Install playground safety surfacing in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Poured in place surfacing shall be installed after all playground equipment, shade structures, signs and any other items that will be within the surfacing area. Surface installation is coordinated by a representative of the manufacturer.

C. Ensure prepared subsurface is dry and clean.

D. Components of the poured in place surfacing shall be mixed on site in a rotating tumbler to ensure components are thoroughly mixed and are in accordance with manufacturer’s recommendations. Installation of surfacing shall be seamless up to 2,000 square feet per day and be completely bonded to concrete of subbase. Material shall cover all foundations and fill around all elements penetrating the surface.

E. Cushion Layer: Whenever practical, cushion layer of surfacing material shall be installed in one continuous pour on the same day of up to 2,000 square feet. When a second pour is required, stop the seam, and fully coat the stop of the previous work with polyurethane binder to ensure 100 per cent bond with new work. Apply adhesive in small quantities so that new cushion layer can be placed before the adhesive dries.

F. Wear Course: Wear Course must be high quality peroxide cured EPDM granules. Wear surface shall be bonded to Cushion Layer. If necessary, additional primer will be used between the cushion layer and Wear Course. Apply adhesive to Cushion Layer in small quantities allowing the Wear Course to be applied before adhesive dries. Surface shall be hand troweled to a smooth, even finish. Except where the Wear Course is composed of differing color patterns, pour shall be continuous and seamless up to 2,000 square feet per day. Where seams are required due to color change, size or adverse weather, a step configuration will be constructed to maintain Wear Course integrity. The edge of initial pour shall be coated with adhesive and wearing surface mixture shall be immediately applied. Pads with multiple seams are encouraged to include a topcoat of urethane before being placed into use. Butt joint seams are not acceptable except for repairs. Under special conditions and with the owner's written approval, seams may be permitted in samt3 color pad. Consult with manufacturer for specific applications.

G. Construction methods such as the use of measured screeds or guides shall be employed to ensure that the full depth of specified surfacing material is installed. Surfacing system thickness throughout the playground equipment use zone shall be as required to meet the impact attenuation requirements specified herein.

3.4 CLEANING AND PROTECTION

A. Manufacturer installers shall work to minimize excessive adhesive on adjacent surfaces or play equipment. Spills of excess adhesive shall be promptly cleaned. Clean playground safety surfacing in accordance with manufacturer's instructions.

B. The safety surface shall be allowed to fully cure in accordance with Manufacturer's instructions. The surface shall be protected by the contractor from all traffic during the curing period of 48 hours or as instructed by the Manufacturer.

C. A manufacturer's representative who is experienced in the installation of playground safety surfacing shall be provided. The representative shall supervise the installation to ensure that the system meets the impact attenuation requirements as specified herein.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fence framework, fabric, and accessories.

B. Excavation for post bases.

C. Concrete anchorage for posts, and center drop for gates, and mow strip, where indicated.

D. Manual gates and related hardware.

E. Sliding gates (power operated).

1.2 SYSTEM DESCRIPTION

A. Fences, gates and hardware in accessible path of travel (POT) shall meet following code requirements for doors: per CBC11B-206.4, 1003.3.1 AND 1003.3.2.
   1. Hardware shall be centered 30-44 inches above floor per CBC 11B-404.2.7.
   2. Hardware that is operable with single effort by lever-type hardware, panic bars, push-pull activating bars or other hardware designed to provide passage without requiring ability to grasp opening hardware per CBC 11B-309.4.
   3. 10" high minimum smooth uninterrupted surface 3 inches maximum from paving on both sides of gate per CBC 11B-404.2.10 or provide sign on or adjacent to gate stating: "This gate is to remain locked in the open position during business/school hours or during any public functions" per CBC 11-703.4.1 and CBC 11B-703.4.2.
   4. Gates in the path of travel shall comply with exit door requirements per CBC 1003.3.

1.3 REFERENCES

A. ASTM A90 - Standards Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

B. ASTM A392 - Zinc-Coated Steel Chain Link Fence Fabric.

C. ASTM A428 - Weight of Coating on Aluminum-coated Iron or Steel Articles.

D. ASTM A569 - Standard Specification for Steel, Carbon, Hot-Rolled Sheet and Strip Commercial Quality.

E. ASTM F567 - Installation of Chain Link Fence.

F. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.

G. ASTM F1083 - Pipe, Steel, Hot-dipped Zinc-coated (Galvanized) Welded for Fence Structures.

H. ASTM F1184 - Industrial and Commercial Horizontal Slide Gates.

I. ASTM F1234 - Protective Coatings on Steel Framework for Fences.

J. Chain Link Fence Manufacturers Institute - Chain Link Fence Wind Load Guide for Selection of Line Post and Line Post Spacing.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in commercial quality chain link fencing with three years documented experience.

B. Installer shall have 5 years of experience in projects of similar scope and size.

C. Installation: Comply with ASTM F567.

D. 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) (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 6 - 2022 California Energy Code

6. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
7. Title 24 CCR, Part 10 - 2022 California Existing Building Code
8. Title 24 CCR, Part 12 - 2022 California Reference Standards
9. 2010 ADA Standards for Accessible Design
10. Americans with Disabilities Act (ADA), Title II or Title III.

E. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

F. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00, unless specified otherwise.

B. Shop Drawings: Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.

C. Submit manufacturer's installation instructions.

D. Submit two samples 12 x 12 inches in size, illustrating fence fabric finish.

E. Submit project record documents under provisions of Section 01 77 00. Accurately record actual locations of property perimeter posts relative to property lines and easements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framework: ASTM F1083; Schedule 40 steel pipe, standard weight, one piece without joints, finish same as fabric.

B. Acceptable Equivalent: ASTM A569; Class 1A pipe with minimum yield strength of 50,000 pounds per square inch as manufactured by Allied Tube and Conduit Fence Division, (800) 882-5543, or approved equal.

C. Fabric: ASTM A392, Class 1, zinc-coated wire fabric.

2.2 CONCRETE MIX

A. Concrete: As specified in Section 03 30 00.

2.3 COMPONENTS

A. Line and terminal posts and footing size and depth shall be sized and spaced according to Table 1, set forth below. Component sizes for fences with requirements not shown in Table 1 shall be calculated using the Chain Link Fence Manufacturers Institute - Chain Link Fence Wind Load Guide for Selection of Line Post and Line Post Spacing or by using the Wind Load Calculator at www.wheatland.com.

TABLE 1 (Assumes Wind Speed MPH = 85)

Fence Height (Ft.)	End Post	Line Post	Post Spacing	Footing Diameter End Post	Footing Diameter Line Post	Footing Depth
2" Fabric - 9 Gauge						
0-4	2-3/8"	1-7/8"	10'	12"	12"	24"
>4-8	2-7/8"	2-3/8"	10'	12"	12"	36"
>8-12	3-1/2"	2-7/8"	10'	16"	12"	54"
>12-14	4"	3-1/2"	10'	16"	16"	60"
>14-16	4"	3-1/2"	8'	16"	16"	60"
1-1/4" Fabric - 9 Gauge						
0-4	2-3/8"	1-7/8"	10'	12"	12"	24"
>4-6	2-7/8"	2-3/8"	10'	16"	12"	30"
>6-8	3-1/2"	2-7/8"	10'	16"	12"	36"
>8-10	3-1/2"	2-7/8"	8'	16"	12"	48"
>10-12	4"	3-1/2"	8'	16"	16"	54"
>12-14	4"	3-1/2"	7'	16"	16"	60"
>14-16	6-5/8"	4"	7'	24"	16"	60"
1" Fabric - 9 Gauge						
0-4	2-3/8"	1-7/8"	10'	12"	12"	24"
>4-6	2-7/8"	2-3/8"	10'	12"	12"	30"

>6-8	3-1/2"	2-7/8"	10'	16"	12"	36"
>8-10	3-1/2"	2-7/8"	8'	16"	12"	48"
>10-12	4"	3-1/2"	8'	16"	16"	54"
>12-14	4"	3-1/2"	7'	16"	16"	60"
>14-16	6-5/8"	4"	7'	24"	16"	60"

B. Top and Brace Rail: 1-5/8 inch NPS, plain end, sleeve coupled steel pipe.

C. Fabric: **2** inch diamond mesh steel wire, interwoven, 9 gage thick, top and bottom selvage knuckle end closed. All fencing in contact with buildings or in areas which permit easy access to buildings and roofs shall be 1 inch fabric.

D. Caps: Cast steel or malleable iron, galvanized; sized to post dimension, set screw retained.

E. Fittings: Galvanized steel sleeves, bands, clips, rail ends, tension bars, fasteners and fittings.

F. Tension Wire: 7 gage thick steel, single strand.

G. Swinging Gates: Constructed of tubular members welded at all corners in conformance with ASTM F900 and the following:

1. Gate Posts: 3 inch NPS steel pipe for gates up to 6 foot for a single gate or a single leaf of a double gate. 4 inch NPS steel pipe for gates over 6 feet and up to 12′ in width. 6-5/8 inch NPS steel pipe for for gates over 12′.

2. Gate Frames: 1-7/8 inch NPS steel pipe, for welded fabrication with vertical intermediate brace at maximum 6 foot spacing and horizontal brace on all gates.

3. Gate Fabric: 2 inch diamond mesh steel wire, interwoven, 9 gage thick, top and bottom selvage knuckle end closed. All gates shall have no climb fabric on latch side of the gate to prevent unwarranted access.

4. Gate Hardware: Refer to 08 71 00

2.4 FINISHES

A. Galvanized: ASTM F1234; 1.8 oz/sq ft coating for Schedule 40 pipe. ASTM A90; 1.0 oz/sq ft coating for Class 1A pipe.

B. Accessories: Same finish as framing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories, and gates in accordance with ASTM F567.

B. Provide fence of height indicated.

C. Space line posts at intervals according to Table 1.

D. Set terminal, gate and corner posts plumb, in 12 inch diameter concrete footings with top of footing 6 inches below finish grade. Slope top of concrete for water runoff. Footing depth below finish grade: As indicated in Table1. Form and place mow strip, where indicated, carefully aligning with the fence. Bottom of footing shall be 6" below bottom of post.

E. Provide top rail through line post tops and splice with 7 inch long rail sleeves.

F. Brace each gate and corner post back to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.

G. Install center and bottom brace rail on corner and gate leaves.

H. Stretch fabric between terminal posts or at intervals of 100 feet maximum whichever is less.

I. Do not stretch fabric until concrete has cured 28 days.

J. Position bottom of fabric 2 inches above finished grade.

H. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties maximum 15 inches on centers.

I. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

J. Install bottom tension wire stretched taut between terminal posts.

K. Install gates with fabric to match fence. Install three hinges per leaf, latch, catches, [drop bolt].

3.2 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch.

B. Maximum Offset from True Position: 1 inch.

C. Components shall not infringe adjacent property lines.

END OF SECTION 32 31 13

SECTION 32 31 19 – ORNAMENTAL STEEL FENCES AND GATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ornamental Fence Framework and Accessories.

B. Swing Gates and related hardware

C. Installation.

1.2 RELATED SECTIONS

A. Section 03 30 00: Cast-In-Place Concrete.

B. Section 05 50 00: Metal Fabrication.

C. Section 08 71 00: Finish Hardware.

1.2 REFERENCES

A. American Society for Testing of Materials (ASTM):
   1. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
   2. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
   3. ASTM D523 - Test Method for Specular Gloss.
   4. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
   5. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
   6. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
   7. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
   8. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

1.4 SYSTEM DESCRIPTION

A. The manufacturer shall supply a complete ornamental fencing system including all components defined herein (fence panels, posts, gates and hardware).

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Submit prior to fabrication. Indicate sizes, shapes, thickness, and types of materials, finishes, fabrication details, anchors, connections, and relationship to adjacent Work. Include complete details of fence and gate construction, gate hardware, fence height, post spacing, dimensions and unit weights of framework and concrete footing details. Actual samples and certificates of compliance may be requested.

1.6 QUALITY ASSURANCE

A. Reference Standards: The 2022 Code of Regulations CCR, CFC, CMC, CPC, CEC Govern
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) (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 6 - 2022 California Energy Code
6. Title 24 CCR, Part 9 - 2022 California Fire Code (CFC) (2018 IFC, as Amended by CA
7. Title 24 CCR, Part 12 - 2022 California Reference Standards
8. 2010 ADA Standards for Accessible Design
9. Americans with Disabilities Act (ADA), Title II or Title III.

B. The Contractor shall be familiar with the construction methods and material involved in ornamental iron fencing.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver to the job site materials in good condition, site verify all components are in good condition and all parts are included and properly protected against damage to factory finished surface.

B. Store materials off ground, under cover. Protect from damage or deterioration.

C. Handle materials to prevent damage to surface, edges, ends, and factory applied finishes of items. Damaged material shall be rejected and replaced.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The industrial ornamental fence system shall conform to Montage II Commercial, 3-Rail, Majestic style manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma.

C. Or approved equal. See 01 60 00 for Substitution requirements

2.2 MATERIALS

A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft^2 (184 g/m^2), Coating Designation G-60.

B. The manufactured framework shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm).

C. Material for fence pickets shall be 1" square x 14ga. thick extruded tubing. The cross-sectional shape of the rails shall conform to the manufacturer's design with outside cross-section dimensions of 1." square X 14ga. Picket holes in the rail shall be spaced 4.75” o.c., except for Invincible style 6’ long, which shall be, spaced 4.75” o.c. Picket retaining rods shall be 0.125” diameter galvanized steel. Fence posts and gate posts shall meet the minimum size requirements of Table 1. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections.

D. Material for top rails, uprights and diagonal rails shall be 2” square X 12ga.

E. Bracket to rail attachments shall be made using specially designed one-way tamperproof security nuts with carriage bolt. Bracket to post connections shall be made using self-drilling hex-head screws.

F. Swing Gates: Pickets for swing gates shall be 1.75” X 14ga forerunner double channel rail, 2” sq. X 14ga pickets Frames for gates shall be of sufficient size and thickness to provide an adequate support without sag. Adjustable trussing may be required. Gate hardware shall be supplied by the manufacturer and shall be of sufficient size and

capacity to support the gate specified. Gates that exceed 6′ shall have a 1.75″ X 14ga intermediate upright and a cable kit shall be provided for all gates over 6′.

1. Pedestrian swing gates shall be self-closing, having a gate leaf no larger than 48″ width. Integrated hinge-closer set (2 qty) shall be ADA compliant that shall include a variable speed and final snap adjustment with compact design (no greater than 5″ x 6″ footprint). Hinge-closer set (2 qty) shall be tested to a minimum of 500,000 cycles and capable of self-closing gates up to a maximum gate weight of 260 lbs. and maximum weight load capacity of 1,500 lbs. Hinge-closer device shall be externally mounted with tamper-resistant security fasteners, with full range of adjustability, horizontal (.5″ - 1.375″) and vertical (0 - .5″). Maintenance free hinge-closer set shall be tested to operate in temperatures of negative 20 F to 200 F degrees, and swings to negative 2 degrees to ensure reliable final lock engagement.
2. Swing gates shall be fabricated using 1.75″ x 14ga Forerunner double channel rail, 2″ sq. x 12ga. gate ends, and 1″ sq. x 14ga. pickets. Gates that exceed 6′ in width will have a 1.75″ sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gates leaves over 6′.
3. Swing Gates with an out-to-out leaf dimension less than and including 72 inches shall be fabricated using Montage Commercial ornamental panel material and 1″ sq. x 14ga. gate ends. Gate leaf's greater than 72 inches shall be fabricated using rails, 17-gauge pickets, intermediate uprights, gussets and 3″ sq. x 14ga. gate ends. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

4. Rolling Gates: Steel material for roll gate components (i.e. pickets, rails, diagonals and uprights), shall be commercial steel with a minimum yield strength of 45,000 psi (344 MPa).
    1. Ornamental picket material shall be 1″ square x 14 Ga. Tubing. Picket spacing shall be 4-3/4″. Material for top rails, uprights and diagonals rails shall be 2″ square x 12 Ga. Material for the bottom rail shall be 2″ x 4″ x 11 Ga. Posts shall be a minimum of 4″ square x 11 Ga.

2.3 FABRICATION (refer to drawings for fence fabrication elevations)

A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. The rail inner slide shall be fully inserted into the rail outer channel to form the raceway for the internal retaining rod. Grommets shall be inserted into the pre-punched holes

in the rails, and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal raceway of the two-part rails. by using an alignment template. Retaining rods shall be inserted into each rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.

C. Gates with an out-to-out leaf dimension less than and including 72 inches shall be fabricated using Montage Commercial Ornamental panel material and 3" sq. x 14ga. gate ends. Gate leaf's greater than 72 inches shall be fabricated using standard 1 ½" rails 14-gauge pickets, intermediate uprights, gussets and 2" sq. x 14ga. gate ends. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

D. Completed fence panels shall be capable of supporting a 300 lb. load (applied at midspan) without permanent deformation. Panels shall be bias able (slope) to a 25% change in grade.

E. Completed rolling gates shall be capable of supporting a 200 lb. load (applied at midspan) without permanent deformation.

2.4 CONCRETE MIX

A. ASTM C94 Portland cement concrete with maximum 3/4 inch aggregate having a minimum compressive strength of 3,000 psi at 28 days.

2.5 FENCE COMPONENTS

A. Installations to 8 feet high:
   1. See tables in PART 3

2.6 SWING GATES

A. Gate frames shall match panels in design and finish, fabricated from materials as shown on Gate Schedule.

B. Install gates using manufacturer recommended gate hardware.

C. Swing Gates:
   1. Gates shall be fabricated as detailed on drawings. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall be joined by welding.
   2. Pedestrian Gate Hardware: Lever latch set into steel lock box.

3. Vehicular Gate Hardware: Fork type latch with gravity drop and provision for padlock; center gate stop and drop rod where indicated, three 180 degree gate hinges minimum per leaf.
4. Man gates: 10 inch minimum high perforated steel kick plate at gate bottom, tack weld to frame and clip for fabric, on push side of gate.

2.7 ROLLING GATES

A. Pickets/pales, rails, uprights and posts shall be precut to specified lengths. Diagonals shall be precut to specified lengths and angles. Frame materials shall be joined by welding. Pickets/pales shall be face welded to roll gate frame, except for Invincible or Gauntlet style gates over 18′ long. Invincible or Gauntlet style gates over 18′ long shall have pickets face-welded to 2″ x 2″ angle iron to form panels equal in length to the gate frame bay width.

1. Gates shall be fabricated as detailed on drawings. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall be joined by welding.
2. Pedestrian Gate Hardware: Lever latch set into steel lock box.

2.8 FINISH

A. The color shall be Black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic.

PART 3 - EXECUTION

3.1 PREPARATION

A. The Contractor shall layout the new fence in accordance with the fence construction plans, Shop Drawings, and all applicable requirements and codes.

B. The Contractor shall verify any grade changes or surface irregularities.

C. Discrepancies between the approved Shop Drawings and field conditions must be approved by the Architect prior to proceeding with the installation.

3.2 FABRICATION

A. Fabricate ornamental fences and gates in accordance with approved Shop Drawings.

B. Connections shall be welded unless otherwise shown on Drawings.

3.3 FENCE INSTALLATION

A. Install fences and gates in accordance with approved Shop Drawing and in accordance with International Fence Industry Association Standards.

B. Refer to manufacturers Tables and requirements for installation requirements.

C. Isolate dissimilar materials by separating with bituminous paint or caulking tape. Protect prefinished surface from damage.

D. Install fences and gates to achieve clearances less than or equal to those shown on the Drawings.

E. Truss and brace as necessary.

F. All posts to be set in concrete footings (minimum) as indicated on Drawings. Space posts 8 feet on center maximum and/OR as noted on plans.

G. Fence posts shall be set plumb and level at spaces shown on the Drawings. Footings shall be of the sizes indicated. Post caps shall be as indicated on the Drawings.

H. Fence post shall be spaced according to drawings plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade.
   1. Fence panels shall be attached to posts with brackets supplied by the manufacturer.
   2. Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer.
   3. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application and must be approved in writing by the Architect..

3.4 FENCE INSTALLATION MAINTENANCE

A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed surfaces.
   1. Remove all metal shavings from cut area.

2. Apply custom finish paint matching fence color.
3. Failure to seal exposed surfaces per steps 1& 2 above will negate warranty and *IS NOT ACCEPTABLE*.
4. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended by the manufacturer that paint pens be used to prevent overspray.
5. Use of non-Ameristar parts or components will negate the manufactures' warranty and is *NOT ACCEPTABLE*.

3.5 SWING GATE INSTALLATION

A. Gates shall be installed plumb and level and shall be the sizes and style indicated on the Drawings. The Contractor shall install any gate stops that may be required. Any padlock provisions or strikes shall be field attached to assure alignment.

B. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
   1. Type and quantity of gate hinges shall be based on the application, weight, height, and number of gate cycles.
   2. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application.
   3. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations.
   4. The Contractor shall lubricate the hinges, rollers, and other gate hardware after installation. Adjust closer function as follows: Set closer-type spring assembly opening pressure at 5 lbs. Closer delay time shall comply with CBC Chapter 11B and with the Americans with Disabilities Act (ADA) paragraph 4.13.10.
   5. All gate hardware is to be fully enclosed and protected from the elements. Provide box enclosure of same material as gate and provide Shop Drawings for Architect's review and approval.

3.6 ROLLING GATES INSTALLATION

A. Gateposts shall be set in accordance with the spacing's shown in the construction plans. The "Earthwork" and "Concrete" sections of this specification shall govern post base material requirements. 6" wheels shall be bolted to the gate (between the wheel plates welded near the ends of the gate bottom rail). The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening.

Roller guides shall be affixed to the gateposts at a height even with the gate top rail to hold the gate in a vertical position. Gate stops shall be welded to the end of the gate or track so gate cannot pass rollers in either direction.

3.7 FINISHING

A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts
B. Clean and touch up all surfaces in a manner appropriate to the finish applied.

B. At completion of Work, touch up and repair damaged surfaces to the satisfaction of the Architect or Owner's Representative. Replace damaged sections as required.

Table 1 – Minimum Sizes for Montage II Posts			
Fence Posts	Panel Height		
2-1/2" x 12 Ga.	Up to & Including 6' Height		
3" x 12 Ga.	Over 6' Up to & Including 8' Height		
Gate Leaf	Gate Height		
	Up to & Including 4'	Over 4' Up to & Including 6'	Over 6' Up to & Including 8'
Up to 4'	2-1/2" x 12 Ga.	3" x 12 Ga.	3" x 12 Ga.
4'1" to 6'	3" x 12Ga.	4" x 11 Ga.	4" x 11 Ga.
6'1" to 8'	3" x 12 Ga.	4" x 11 Ga.	6" x 3/16"
8'1" to 10'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
10'1" to 12'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
12'1" to 14'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
14'1" to 16'	6" x 3/16"	6" x 3/16"	6" x 3/16"

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

	Table 3 – Montage II – Post Spacing By Bracket Type									
Span	For INVINCIBLE® 8’ Nominal (91-1/2” Rail)				For CLASSIC, GENESIS, & MAJESTIC 8’ Nominal (92-5/8” Rail)					
Post Size	2-1/2”	3”	2-1/2”	3”	2-1/2”	3”	2-1/2”	3”	2-1/2”	3”
Bracket Type	Industrial Flat Mount (BB301)*		Industrial Line 2-1/2” (BB319) 3” (BB320)		Industrial Universal 2.5” (BB302) 3” (BB303)		Industrial Flat Mount (BB301)		Industrial Swivel (BB304)*	
Post Settings ± ½” O.C.	94-1/2”	95”	94-1/2”	95”	96”	96-1/2”	96”	96-1/2”	*96”	*96-1/2”
*Note: When using BB304 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel. When using the BB301 flat mount bracket for Invincible style, rail may need to be drilled to accommodate rail to bracket attachment.										

END OF SECTION 32 31 17

SECTION 32 33 00: SITE FURNISHINGS

PART 1 - GENERAL

1.01 PRINCIPAL WORK IN THIS SECTION

- [illegible] **Owner's** [illegible]
  - [illegible]
- [illegible]
- [illegible]
- [illegible]
  - [illegible]
  - [illegible]
  - [illegible]

1.02 REFERENCE STANDARDS

- [illegible]
- [illegible]
  - [illegible]
    - [illegible]
- [illegible]
- [illegible]
  - [illegible]
  - [illegible]
  - [illegible]
- [illegible]

F. [illegible]

1.03 PERFORMANCE, TESTING AND INSPECTION

- **General:**
  - [illegible]
  - [illegible]

- **Sustainability:**
  - [illegible]
  - [illegible]

1.04 SUBMITTALS

- [illegible]
- [illegible]
- [illegible]
  - [illegible]

1.05 QUALITY ASSURANCE

- [illegible]
- [illegible] **five (5)** [illegible]
- [illegible] **five (5)** [illegible]

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

Per mfgr’s recommendations

2.03 OTHER MATERIALS

PART 3 - EXECUTION

3.01 INSPECTION / EXAMINATION

General Contractor

3.02 COORDINATION

General Contractor

3.03 PREPARATION

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 32 84 00 - LANDSCAPE IRRIGATION

PART 1 GENERAL

1.1 SECTION INCLUDES

□□ System design, trenching, laying of pipes and control wires, installation of valves, sprinkler heads, backfill, testing, adjustment and be complete, ready for operation.

1.2 RELATED SECTIONS

□□ Section 32 90 00 – Landscape Planting

1.3 REFERENCES

□□ The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 for definitions, acronyms, and abbreviations.

□□ Referenced Standards, Manuals and Codes:

- □□ ASTM D1785 – Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- □□ ASTM D2241 – Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
- □□ ASTM D2466 – Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

1.4 INTENT OF SPECIFICATIONS

□□ It is the intention of these specifications to design and install a sprinkler system free from defects in materials and workmanship.

1.5 ORDINANCES AND REGULATIONS

□□ All local, municipal, and state laws, rules and regulations governing any portion of this work shall be made a part of these specifications and their provisions carried out.

1.6 EXAMINATION OF DRAWINGS AND SITE

□□ Before submitting a bid, each bidder shall carefully examine the site and note all existing conditions and limitations applying to the work including "patch and repair" considerations to the existing irrigation system and the surrounding landscape and include in his bid a sum sufficient to cover the cost of all items.

1.7 PROTECTION

□□ The Contractor shall be responsible for covering all pipe openings, valves, etc., before and after being set in place to prevent obstructions in the pipe and valves.

1.8 DAMAGE TO PROPERTY

□□ The Contractor shall restore it to its original condition, without change, any damage due to the negligence of any of the Contractor's employees, agents or subcontractors.

□□ Any existing buildings, equipment, piping, pipe coverings, sewers, sidewalks, landscaping, etc., damaged during his work shall be replaced or repaired in a manner satisfactory to the Architect and at the Contractor's own expense and before final payment will be made.

1.9 DAMAGE BY LEAKS

□□ The Contractor shall be responsible for damage to the grounds, walks, roads, building, piping systems, electrical systems and their equipment and contents caused by leaks being installed or having been installed. He shall repair at his expense all damage so caused. All repair work shall be done in a manner satisfactory to the Architect.

PART 2 PRODUCTS

2.1 LIST OF MATERIALS FOR APPROVAL

□□ Within 20 days after the Award of Contract, the Contractor shall submit to the Architect for review five copies of a complete materials list, together with the manufacturer’s name numbers covering all material to be furnished under this contract. The contract shall also furnish five copies of descriptive literature on all items listed on the material list. No work shall be commenced before receipt of approved material list and descriptive material. List shall cover items listed below if specified or indicated on drawings:

Shut-off valves

Valve boxes

Backflow prevention device

Master valve

Flow sensor

Copper pipe and fittings

Remote control valves

Remote control valve ID tags

Automatic controller

Control wire and connectors

Check valves

Sprinkler heads

Drip irrigation equipment

2.2 SHUT-OFF VALVES

□□ (Except when a part of the backflow prevention device), 1/2" through 2" shall be 150 lbs. WOG bronze gate valves non-rising stem and wheel. Gate valves shall be Nibco T-29 or Hammond #4687. 3" and larger shall be AWWA resilient wedge gate valve. The body shall be epoxy coated inside and out, with "0" push-on ends for PVC via rubber rings. Gate valves shall be Stockham, Mueller, Kennedy or approved equal. All gate valves shall be domestically manufactured.

2.3 VALVE BOXES FOR SHUT-OFF VALVES

□□ 10" round plastic valve box with bolt down cover, extensions as required. Carson #910-12B or approved equal.

2.4 COPPER WATER TUBING

□□ Hard drawn government type "K" water tube. Use type where indicated on drawings.

2.5 FITTINGS – NON-FERROUS METAL (for copper water tubing)

□□ Wrought copper and/or cast red brass for solder and/or screw connections with name and manufacturer thereon.

2.6 SOLDER

□□ Solder for copper water tube shall be 95-5, tin-antimony.

2.7 RED BRASS PIPE

□□ Federal specification No. WW=P-351 medium weight, IPS, with threads to conform to ASA Specifications B2.

2.8 DI-ELECTRIC ISOLATION

□□ Provide between all connections joining ferrous and non-ferrous metals or old (existing) ferrous and new ferrous metals. Submit for approval, type "intended for use".

2.9 PVC PIPE

□□ All PVC pipes shall be permanently and continuously marked with manufacturer's name, pipe size (IPS), class or schedule SDR number (class pipe only), ASTM (D-2241 for class pipe and D-1785 for schedule pipe), manufacturer's lot number and NSF approval. Pipe with dents, wrinkles, die, or heat marks is not acceptable. Pipe shall be delivered to the site in 20' lengths.

2.10 THREADED PVC NIPPLE

□□ SCH 80, type 1, 4" minimum length, except where detailed otherwise in drawings.

2.11 PVC MAINLINE

□□ 1120/1220 normal impact, SCH 40 and Class 315, solvent weld; size as noted in drawing.

2.12 PVC LATERALS (NON-PRESSURE PIPING)

□□ 1120/1220 normal impact, SCH 40, solvent weld type PVC; size as noted in drawing.

□□ As indicated in the drawings.

2.13 FITTINGS – PVC

□□ PVC fittings for make-up shall be of the same chemical compound as the pipe on which it is installed. Use ASTM D2466 Type 1 or I/II SCH 40 Polyvinyl Chloride fittings.

2.14 PIPE COMPOUND FOR PVC

□□ Best grade Teflon tape on all threaded connections.

2.15 PRIMER AND SOLVENT

□□ As recommended by the manufacturer of the PVC pipe, chemically compatible with the pipe, fittings and solvent.

2.16 REMOTE CONTROL VALVES

□□ Refer to drawings.

2.17 WIRING TO REMOTE CONTROL VALVES (24 VOLT), MASTER VALVE AND FLOW SENSOR

□□ Electrical requirements from controller to remote control valves shall be U.F. type, UL approved, AWG #14 solid strand copper wire with minimum 4/64" PVC coating, 600-volt, 75°C. All control wires from the valve to the controller shall be of one color. Common wire shall be white. Master valve and flow sensor color must be different than control valve color.

2.18 WIRE CONNECTIONS FOR DIRECT BURIAL WIRE

□□ Connector shall be 600-volt, 60°C, AWG-UF type, waterproof, epoxy or PVC compound filled containers, 3M seal packs or approved equal.

2.19 SPRINKLERS HEADS

□□ Refer to drawings.

PART 3 EXECUTION

3.1 GENERAL

□□ Comply with all governing construction for all work under this section.

□□ All work shall be assembled to conform to notes on the drawings, whether mentioned in this section of the specifications.

□□ Observe installed work of other trades and verify that it is complete to the point where irrigation work may properly commence.

□□ Provide at least one qualified person who shall be present always during execution of the work. This person shall be familiar with the type of materials being installed and the material manufacturer's recommended methods of installation and direct all work performed under this Section.

3.2 VERIFICATION OF DIMENSIONS

□□ Verify all horizontal and vertical site dimensions prior to staking of heads.

3.3 LAYOUT OF HEADS AND STAKING

□□ Sprinkler heads shall be staked and installed in the locations shown on the shop drawings. Discrepancies between drawings and site shall be brought to the attention of the Architect prior to trenching. Do not exceed maximum spacings shown on drawings or exceed the GPM of the pipe sizes shown. If spacing demands additional or less materials, notify Architect before commencing work.

3.4 TRENCHING

□□ Check all grades so that work may proceed, keeping materials at specified depth.

□□ Do all excavation for installation of work included in contract. Mechanical trenching machines shall be of approved type to cut trenches with straight sides. Trenches shall be only wide enough to lay the pipe and control wires. Perform minor adjustments to avoid existing utilities as directed without additional cost. "Pulling" of piping and/or control wires will not be permitted.

□□ Trenches shall be deep enough to provide minimum cover from finish grade as follows:

- □□ 18” minimum cover over supply lines to remote control valves which go under concrete or porous pavement system.
- □□ 18” minimum cover over control wires from controller to valves.
- □□ 12” minimum cover over lateral lines to sprinkler heads.

□□ Hand trench within the drip line of all trees with a caliper greater than 8”.

□□ Use all possible care to protect existing trees and plants, during trenching. Roots 2" or larger in diameter shall be tunneled under and wrapped with wet burlap to prevent scarring or drying. When roots 1” and larger are cut, they shall be painted with two coats of approved sealer manufactured for this purpose. Cover all trenches in root areas (only while open) with wet burlap and backfill within 24 hours after opening the trench.

□□ If the pipe must be laid after paving is in place, it shall be done by jacking, boring or hydraulic driving. Boring is unacceptable under AC pavement. If cutting or breaking any paving is necessary, it shall be done and replaced with like material at the expense of the Contractor after obtaining the approval of the Architect.

□□ All pipes under concrete shall be sleeved inside of larger pipe and have 1/2" clearance.

3.5 BACKFILLING

□□ The trenches shall not be backfilled until all required tasks and testing are performed and reviewed by the Architect. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from large clods of earth or sharp stones.

□□ Backfilling for pressure piping shall be compacted and tamped as follows:

□□ Install backfill material and cover over piping. Add 6" lifts of backfill soil and mechanically tamp.

□□ After the system is working, run sprinklers for a minimum of one hour and retamp as needed. NO WHEEL ROLLING WILL BE ALLOWED.

□□ Backfill for any trench shall be compacted to dry density equal to 90% and conform to the adjacent grades without dips, sunken areas, humps, or other irregularities.

□□ All rocks uncovered and debris must be disposed of by Irrigation Contractor off-site at his cost.

3.6 ASSEMBLY

□□ Copper pipe

□□ Cut ends square; remove all burrs inside and out.

□□ Clean tube and pocket or fittings to bright finish using #00 steel wood or sand cloth.

□□ Coat tubing and inside of fitting with a paste-type non-corrosive solder flux and assemble.

□□ Apply heat and solder. Do not use oxygen gas.

□□ Remove residual solder and flux with rag or brush and allow joint to cool.

□□ Fill pipe with water and pressure test.

□□ PVC Plastic Pipe

□□ Handle with care when loading, unloading, transporting, and storing material to avoid damage. Store pipe and fittings under cover before using. Transport in vehicle with bed or sufficient length to carry pipe flat and fully supported. Store pipe in same manner.

□□ Solvent welding: Use non-synthetic brush to spread primer and solvent using no larger than pint-sized cans. Clean and refill cans each day. Cut pipe square, ream, chamfer

outside end. Clean and dry pipe end with prime, prime inside socket again. Immediately apply solvent to pipe end and to socket, then again to pipe end. Bottom the pipe in socket and turn 90°. Hold joint together 30 seconds. Wipe off excess solvent. To set 30 minutes before moving. Centerload pipe with small amount of backfill to prevent arching and whipping under pressure, leave joints exposed.

□□ Threaded connections: Use Teflon tape on plastic threaded joints. Screw hand tight and another half turn by wrench. On PVC to metal pipe, work the metal connection first.

3.7 LAYING OF LINES

□□ All lines set in place under paving shall extend 12" minimum beyond such paving edges and be capped hand tight. No fittings, including couplings, will be permitted under surfaces to be paved except where the length of the line under the paving exceeds 20’ or where shown in drawings, i.e., parking lots, etc.

□□ All piping shall be installed by conventional trenching. The width of the trenches for the irrigation system shall not be greater than necessary to permit satisfactory jointing and other installation procedures, such as tamping of bedding material under and around the pipe. The bedding surface shall provide a firm foundation of uniform density through the entire length of the pipe. Snake PVC plastic pipe side to side in trench bottom keeping 4" horizontal clearance between two pipes in same trench. Maintain 3” between side of pipe and side of trench. Do not allow stacking of pipe within trench.

□□ Do not lay pipe in trench containing water or at less than 32°F. Center load immediately, leaving joints exposed.

□□ Allow a minimum clearance of twelve inches (12”) in any direction from parallel pipes of other trades.

3.8 LAYING OF CONTROL WIRES (24 VOLTS)

□□ Lay wires in common trench with mainline wherever possible. Splicing as allowed with 24” expansion loop only in concrete electrical junction box with bolt down lid. Common wire and control wires are to be tagged with 1/4" wide embossed plastic labeling tape, showing controller and station number designation. Use plastic electrical tape and bind all control wires in bundles at 10’ intervals. All splices shall be waterproof.

3.9 FLUSHING OF LINES

□□ Mainlines shall be flushed before attaching remote control valves with pipe centerloaded. All water being discharged shall be temporarily piped up and out of the trenches. Trenches are to be kept dry for pressure tests to follow. Install all valves after flushing procedures.

□□ Laterals shall be flushed before sprinkler heads are installed. Cap all risers, apply pressure, remove caps in sequence starting at the nearest control valve. Replace caps before removing

caps to follow. Continue to end each lateral. Flush until all foreign matter and mud is cleared out of the system. Contractor to provide all materials needed for flushing operations.

3.10 PRESSURE TESTS

□□ Prior to Backfilling, perform all hydrostatic tests in presence of the IOR after flushing lines. Maintain maximum pressure on main lines and lateral lines, after welded plastic joints have cured at least twenty-four hours and with the risers capped, without any pressure drop with all air expelled at 125 PSI on mainline for four hours and 100 PSI on lateral lines for one hour. All leaks shall be corrected in a mechanical manner without use of epoxy filler compounds.

3.11 DRAWINGS OF RECORD

□□ Maintain a complete and accurate set of project record drawings. These drawings shall be kept up to date with the progress of the work.

□□ The contractor shall provide adequate measurements and field notes as directed by the City Inspector and/or Architect for preparation of accurate "Project Record" drawings. Show either actual locations or dimensions form two permanent points of reference such as building corners, curbs, sidewalk, intersections, etc. (but not from irrigation equipment) locations of the following.

- □□ Connections to existing water sources.
- □□ Water meters.
- □□ Routing of main lines.
- □□ Control valves.
- □□ Quick couplers.
- □□ Backflow prevention devices.
- □□ Gate valves.
- □□ Routing of control wiring.
- □□ Controllers.

3.12 LOWERING HEADS, VALVE BOXES, QUICK COUPLER VALVES, ETC.

□□ All the above and any other equipment that may be damaged by mowing shall be set flush to finished grade or as called out on the drawings, prior to final acceptance. Replace any equipment damaged by mowing during the Owner's first 60 days of maintenance after the conclusion of the Contractor's maintenance period at no cost.

3.13 ADJUSTING SYSTEM

□□ Adjust entire system prior to coverage test and again at conclusion of maintenance period.

□□ Set all shut-off valves in the system to fully open positions.

□□ Adjust all stationary heads to uniform coverage on each system using adjusting screws in each sprinkler head and by control of the throttle device on each remote-control valve.

□□ Adjust all rotary head systems using pitot tube with pressure gauge attached by regulating the remote-control valve. Adjust all radii to fit requirements on drawings if heads are equipped with such a device. Follow the same procedures for impact heads.

□□ Adjust arcs of all heads to prevent overspray on areas to be kept dry. These changes or adjustments shall be made without additional cost.

3.14 COVERAGE TEST

□□ When installation of the sprinkler system is completed, perform a coverage test in the presence of the Architect to determine that coverage for planting and turf areas is complete and adequate. This test shall be accomplished before any turf is planted. Where inadequate coverage occurs, the Contractor shall provide necessary material and perform work to correct all inadequacies.

3.15 CONTROLLER CHARTS

□□ Project record drawings shall be prepared by the Contractor before the charts are prepared.

□□ Provide one controller chart for each controller supplied.

□□ The chart shall show the area controlled by an automatic controller and shall be the maximum size controller door will allow.

□□ The chart is to be reduced drawing of the installed system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.

□□ Chart shall be black line print, and a different color shall be used to show area of coverage for each station. Provide one digital copy of the colored chart to the Owner along with the record drawings.

□□ The chart shall be mounted using Velcro, or an approved equal type of comparable quality.

□□ When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mil. thick.

□□ These charts shall be completed and approved prior to final inspection of the irrigation system.

3.16 ITEMS FURNISHED

□□ At time of final acceptance, Contractor shall deliver to the Owner:

□□ Two tools for disassembly and assembly or adjustment, for each type of sprinkler equipment used in this installation requiring such special tools.

□□ Two sets of operation instructions and parts lists, as printed by each manufacturer of each type of equipment installed, in a three-ring binder. Refer to "Materials" section of the specifications and legend on drawings.

□□ Two sets of a list of equipment with names and addresses of manufacturers' representatives, in a three-ring binder.

3.17 FINAL ACCEPTANCE

□□ All equipment shall be checked and adjusted in height locations, performance and appearance at the time of final acceptance.

□□ All damaged portions shall be replaced with new materials of the like kind.

END OF SECTION

SECTION 32 90 00

LANDSCAPE PLANTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- Landscape finish grading
- Soil preparation
- Concrete Headers
- Tree supports
- Planting, including lawn
- Watering
- Observation schedule
- Clean-up

1.2 RELATED SECTIONS

- Section 32 84 00 – Landscape Irrigation

1.3 QUALITY ASSURANCE

- Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- Approvals: Sprinkler work shall be inspected, tested, and approved before the start of any work of this Section. Before covering and backfilling subsurface drains and any surface drain lines, inspect and be responsible for performance thereof.
- Legal Requirements: Give adequate and required legal notices to Owner, utility organization and governing authorities prior to commencing.
- Source Quality Control
  - Plants shall be subject to inspection and approval at place of growth or upon delivery for conformity to specifications. Such approval shall not impair the right inspection and rejection during progress of the work.

1.4 DELIVERY, STORAGE AND HANDLING

□□ Delivery

□□ Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and conformance to State Law.

□□ Deliver plants with legible identification labels.

□□ Label trees, evergreens, bundles of containers of like shrubs or groundcover plants.

□□ State correct plant name and size indicated on plant list.

□□ Use durable waterproof labels with water-resistant ink which will remain legible for at least 60 days.

□□ Protect plant material during delivery to prevent damage to root balls or desiccation of leaves.

□□ The Contractor shall notify the Architect 48 hours in advance of delivery of all plant materials and shall submit an itemized list of the plants in each delivery.

□□ Storage:

□□ Store plant material away from construction activity areas.

□□ Maintain and protect plant material.

□□ Handling:

□□ Do not drop plant materials.

□□ Do not pick up container plant material by stems or trunks.

1.5 CERTIFICATION

□□ Prior to start of work, submit written certification (purchase order receipts), to Owner and Architect for following items:

□□ Quantity of commercial fertilizer and organic fertilizer.

□□ Quantity of all specified soil amendments and bark mulch.

□□ Quantity of seed.

□□ Quantity of trees, shrubs and groundcover plants.

1.6 JOB AND ENVIRONMENTAL CONDITIONS

□□ Verification of Existing Conditions: Examine site and determine and verify existing conditions including subsurface conditions. Written dimensions take precedence over scaled dimensions; verify and be responsible for dimensions and conditions. Notify Architect in writing of any variations from dimensions and conditions shown; submit to Architect for signed approval before proceeding with landscaping.

□□ Planting: Perform actual planting only when weather and soil conditions are suitable in accordance with locally accepted practice.

□□ Scheduling: Install trees, shrubs and liner stock plant material before lawn areas are installed.

1.7 COORDINATION

□□ Coordinate operation with other trades, utility firms, street tree department and other affected public departments to assure continuity of access and service in conformance with applicable requirements specified.

1.8 PLANT MATERIAL

□□ Locate and secure plant material within 15 days of Award of Contract to avoid last minute plant substitutions.

□□ Landscape Architect reserves the right to deny substitutions if evidence of this effort has not been made prior.

1.9 SAMPLES AND TESTS

□□ Architects reserve the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by Architect. Rejected materials shall be immediately removed from the site at the Contractor's expense. The cost of testing of materials not meeting specifications shall be paid by Contractor.

□□ Following completion of rough grading and topsoiling, a soil test shall be performed by the landscape contractor to determine agricultural suitability of the existing soils.

□□ Take one (1) sample for every 5,000 s.f. of landscape area up to a maximum of six (6) samples.

□□ Provide analysis of soil samples for PH, salinity, ammonia, phosphate, potassium, calcium, magnesium, boron, and sodium levels. Provide appraisal of chemical properties, including particle size determination, and recommendations for types and quantities of amendments and fertilizers.

□□ Instruct the lab to include a minimum recommendation of two (2) cubic yards per 1,000 square feet of landscape area.

1.10 GUARANTEE AND REPLACEMENTS

□□ Guarantee: All plant material installed under the Contract shall be guaranteed against all poor, inadequate or inferior materials and/or workmanship for a period of 90 days. Guarantee period to start at the end of the contract maintenance period and acceptance of work. Any plant found to be dead or in poor condition due to faulty materials or workmanship, as determined by the Architect, shall be replaced by the Contractor at his expense.

□□ Replacements: Any materials found to be dead, missing or in poor condition during the contract maintenance period shall be replaced immediately. The Architect shall be the sole

judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within 15 days of written notification by the Owner.

□□ Contractor will not be held responsible under the above guarantee for damage arising from acts of God, vandalism, theft, negligence, or inadequate maintenance following the 90-day maintenance period.

PART 2 PRODUCTS

2.1 GENERAL

□□ The following organic and soil amendments and fertilizer are to be used for bidding price basis only. Specific amendments and fertilizer specifications will be made after grading operations are complete and samples are tested by the Contractor.

□□ All materials shall be of standard, approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis. Contractor shall supply Architect with a sample of all supplied materials accompanied by analytical data from an approved laboratory source illustrating compliance or bearing the manufacturer's analysis.

2.2 ORGANIC AMENDMENT

□□ Nitrogen Stabilized: 0.56 to 0.94 N based on dry weight for composted fir or pine bark fines.

□□ Particle Size: 95% – 100% passing 6.35 mm standard sieve. 64% passing 2.33 mm standard sieve.

□□ Salinity: The saturation extract conductivity shall not exceed 3.5 millimhos/centimeter at 25°C as determined by saturation extract method.

□□ Iron Content: Minimum .06 silute acid soluble Fe on dry weight basis.

2.3 SOIL AMENDMENT (as required by soil test)

□□ Soil Sulphur: Agricultural sulfur containing a minimum of 99% sulphur (expressed as elemental).

□□ Iron Sulfate: 20% iron (expressed as metallic iron), derived from ferric and ferrous sulphate, 10% sulphur (expressed as elemental).

□□ Calcium Carbonate: 95% lime as derived from oyster shells.

□□ Gypsum: Agricultural grade product containing 98% minimum calcium sulphate.

□□ Dolomite Lime: Agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing #65 Kaiser Dolomite 65 AG or approved equal.

□□ Calcium Nitrate: Agricultural grade containing 15.5% nitrogen.

2.4 FERTILIZER

□□ Backfill fertilizer: Shall be Osmocote Controlled Release Formula (19-6-12, 4-month formula).

□□ Soil Prep. Fertilizer: Shall be Simplot 6-20-20 MN Planting & Growing Food and shall consist of the following percents by weight:

6% nitrogen

20% phosphoric acid

20% potash

2.5 IMPORT SOIL

□□ Fertile, friable, natural top loam, free of alkali, noxious week seed, admixtures of clay, subsoil rocks larger than 1-1/2" diameter, sticks, debris, detrimental to healthy plant growth, pH reading of not less than 6.5 or more than 7.5. Import when required, shall be obtained from source approved by Architect.

2.6 PLANT MATERIAL

□□ Plants shall be in accordance with the California State Department of Agriculture's regulations for nursery inspections, rules, and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous, and free of insect infestations, plant diseases, sun scalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and well "hardened" off. All plants shall normally have well-developed branch systems and vigorous and fibrous root systems which are not root- or pot-bound. In the event of disagreement as to the condition of the root system, the root conditions of the plants furnished by the Contractor in containers will be determined by removal of earth from the roots of not less than two plants of each species or variety. Where container-grown plants are from several sources, the roots of not less than two plants of each species or variety from each source will be inspected. In case the sample plants inspected are found to be defective, the Architect is the sole judge as to acceptability. Any plants rendered unsuitable for planting because of this inspection will be considered as samples and will be provided at the expense of the Contractor.

□□ The size of the plants will correspond with that normally expected for species and variety of commercially available nursery stock or as specified in the drawings. The minimum acceptable size of all plants, measured before pruning with the branches in normal position, shall conform with the measurements, if any, specified on the drawings in the list of plants to be furnished.

Plants larger in size than specified may be used with approval of the Architect, but the use of larger plants will make no change in Contract price. If the use of larger plants is approved, the ball of earth or spread of roots for each plant will be increased proportionately.

□□ All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size, and condition specified herein or as shown on the drawings. Under no conditions will there be any substitution of plant or sizes listed on the accompanying plans, except with the expressed written consent of the Architect.

□□ At no time shall trees or plant materials be pruned, trimmed, or topped prior to delivery and any alteration of the shape shall be conducted only with the approval and when in the presence of the Architect and as noted on the Planting Specifications.

□□ Nursery Grown and Collected Stock:

□□ Grown under climatic conditions like those in locality of project when possible.

□□ Container-grown stock in vigorous, healthy condition, not root-bound or with root system hardened off.

□□ Use only liner stock plant material which is well established in removable containers or formed homogenous soil sections.

□□ Lawn Seed

□□ Overseed existing lawn with a seed mix variety similar to the existing lawn.

2.7 TREE STAKING MATERIAL

□□ Stakes for tree support shall be wood stakes; lodge pole pine stakes full-length treated with copper naphthanate. Minimum nominal size: 2" in diameter x 8′ long and pointed at one end (adjust length to fit tree). Stakes shall be free from knots, checks, splits, or disfigurements.

□□ Ties: "Tie-it super" tree tie by Arthur Enterprises, available at Normac.

2.8 BARK MULCH

□□ Shredded Cedar bark mulch by Redi Gro or approved equal.

□□ The mulch shall consist of fibrous, woody bark mixture of varied particle sizes.

2.9 PRE-EMERGENT WEED CONTROL

□□ Oxadiazon, “Treeflan”, “Ronstar 2G”, “Surflan” (Elano Products Company), or approved equal.

2.10 ROOT BARIERS

□□ NDS EP series root barrier panel, or equal.

□□ EP-2450 24" L x 24" W

2.11 OTHER MATERIALS

□□ Materials not specifically described but required for the complete and proper installation of the Work of this Section shall be as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.1 GENERAL

□□ Install materials in accordance with all the methods, techniques and specifications published by each representative manufacturer. All pertinent descriptive literature issued by any of these manufacturers forms a part of these specifications after approval.

3.2 WEED CONTROL

□□ Irrigate the site normally for two weeks to germinate weeds. Apply contact herbicide per manufacturer recommendation. Repeat process if required by Architect.

□□ If bermudagrass or crabgrass is present or there is a possibility that it is latent in the soil, this process must be repeated a minimum of three times prior to disturbance of soil. If irrigation is not present, this process must be conducted after installation of the irrigation system and before planting.

□□ Eradication of crab grass and bermudagrass must be performed between the months of May and September unless authorized otherwise by the landscape architect.

3.3 LANDSCAPING GRADING

□□ Backfill, Fill Soil: Prior to installation of any imported soil or backfill, gravel fill or sub-base, inspect integrity of waterproofing and dampproofing membranes and for satisfactory correction of any defects which might affect the performance of the above membranes prior to proceeding.

□□ Rip subgrade in two directions to a depth of 12" prior to placement of topsoil.

□□ Import Soil: Import additional topsoil only as required to bring planting areas up to finish grade, of quality specified herein. Spread and cultivate topsoil so no settling takes place at any time.

□□ Landscape Fine Grading: Resieve previously prepared areas rough graded to within about 1/10' of finish grade unless otherwise instructed. Bring areas to finish grades indicated, anticipating soil conditioners and amendments. Grades not specifically indicated to be as follows:

□□ 2" below adjacent paving, curbs, and mowing strips for sod lawn.

□□ 1" below adjacent paving, curbs, and mowing strips for hydroseed lawn.

□□ 2" below adjacent paving, curbs and mowing strips for shrubs and groundcover beds.

□□ Jute Netting – Jute netting shall be installed on all slopes exceeding 2 ½:1. Netting shall be laid perpendicular to the contours, overlapping min. 6" and secured with staples @ 4' o.c.

3.4 INSPECTION

□□ Verify that final rough grades (=.2 of finish grade) have been established prior to beginning planting operations. Inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning. Do not begin planting trees until deficiencies are corrected or plants replaced.

3.5 PREPARATION

□□ The irrigation system shall be operational and approved prior to planting.

3.6 INSTALLATION

□□ Preparation of Planting Areas

□□ After the approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Nitrogen stabilized organic amendment and Planting & Growing Food shall be uniformly spread and cultivated thoroughly by means of mechanical tiller into the top 6" of soil.

□□ The following organic, soil amendments and fertilizer rates and quantities are to be used for a bidding basis only. Specific planting specifications will be made following rough grading operations are complete, and soil samples are tested by Contractor.

□□ Application Rates:

□□ Nitrogen stabilized organic amendment - 6 cu. yds. per 1,000 sq. ft.

□□ If the lab recommends less than 6 cu. yds. Per 1,000 sq. ft., the excess bid amount shall be applied to the cost of any additional soil improvements or returned to the Owner as a credit.

□□ Simplot 6-20-20 MN Planting & Growing Food -30 lbs. per 1,000 sq. ft. for shrub and ground cover areas, 20 lbs. per 1,000 sq. ft. for lawn areas.

□□ NOTE: Contractor shall ensure that iron sulfate does not contact walks, walls, or other landscape surfaces. All stains on these surfaces, because of iron sulfate overthrow, will be the responsibility of the Contractor.

□□ All soil areas shall be compacted and settled by application of heavy irrigation to a minimum depth of 12".

□□ At the time of planting, the top 2" of all areas to be planted or seeded shall be free of stones, stumps or other deleterious matter 1" in diameter or larger and shall be free from all wire, plaster or similar objects that would be a hindrance to planting or maintenance.

□□ Final Grades:

□□ After the foregoing specified deep watering, minor modifications to grade may be required to establish the final grade. These areas shall not be worked until the moisture content has been reduced to a point where working it will not destroy soil structure.

□□ Finish grading shall ensure proper drainage of landscape areas. All surface drainage shall be away from all building foundations.

□□ Disposal of Excess Soil: Dispose of unacceptable or unused excess soil.

3.7 PLANTING INSTALLATION

□□ General

□□ Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Architect.

□□ Only as many plants as can be planted and watered on that same day shall be distributed in the planting area.

□□ Containers shall be opened, and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

□□ Excavation for Planting

□□ Shape:

□□ Vertical sides and flat bottom.

□□ Plant pits to be square for box material, circular for canned material.

□□ Size: All trees shall have planting pits dug twice the diameter of the root ball. The depth of the planting pits shall be equal to the depth of the root ball. Backfill around the root ball with prepared backfill mix.

□□ Protect all areas from excessive truck or equipment compaction when offloading plants or other material directly in the planting areas.

□□ Can Removal:

□□ Cut cans on two sides with an acceptable can cutter.

□□ Do not injure the root ball.

□□ Do not cut cans with spade or ax.

□□ Carefully remove plants without injury or damage to the root ball.

□□ After removing the plant, superficially cut the edge roots with knife on three sides.

□□ Box Removal:

□□ Remove the bottom of plant boxes before planting.

- Remove sides of box without damage to root ball after positioning plant and partially backfilling.

- Setting Plants:
  - Center plant in pit or trench.
  - Face plants with fullest growth into prevailing wind, (or as otherwise directed by Architect).
  - Set plant plumb and hold rigidly in position until soil has been tamped firmly around ball or roots. Crown of rootball shall be set 1-1/2" higher than adjacent finish grade.
- Backfilling
  - Container plants shall be backfilled with:
    - Six parts by volume Native soil
    - Four parts by volume soil amendment
    - Osmocote Controlled Release per manufacturer's recommendations.
  - All plants which settle deeper than specified above shall be raised to the correct level. After the plant has been placed, additional backfill shall be added to the hole to cover approximately one-half of the height of the root ball. Water thoroughly to saturate root ball and adjacent soil.
  - Add remaining backfill to bring up to grade, foot tamp and water thoroughly to remove all air pockets.
  - The preceding is for bid basis only and specific backfill specifications will be made after rough grading operations are complete and soil samples are tested by the Contractor.
- Watering basins:
  - After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least 2" of water. Basins shall be of a size suitable for the individual plant. In no case shall the basin for a fifteen-gallon plant be less than 4' in diameter, five-gallon plants less than 3' in diameter and a one-gallon plant less than 2' in diameter. The basins shall be constructed of amended backfill material.
- Pruning:
  - Pruning shall be limited to the minimum necessary to remove injured twigs and branches to compensate for loss of roots during transplanting, but never to exceed one-third of the branching structure. Upon approval of the Architect, pruning may be done before delivery of plant, but not before plants have been inspected and approved.
- Staking:
  - Staking of all trees shall conform to tree staking details.

□□ Planting of Groundcovers:

□□ Groundcover plants shall be grown in one-gallon containers, flats, peat pots or taken as cuttings, as indicated on the plans. Flat grown plants (rooted cuttings) shall remain in those flats until transplanting. The flat's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants. If plants from peat pots are used, the pots shall be always protected prior to planting to prevent unnecessary drying of the root ball.

□□ Groundcover shall be planted in straight rows and evenly triangularly spaced, unless otherwise noted and at intervals called out in the drawing.

□□ Each rooted plant shall be planted with its proportionate amount of flat soil or in a peat pot, in a manner that will ensure minimum disturbance of the root system, but in no case shall this depth be less than two nodes. To avoid drying out, plantings shall be immediately irrigated after planting until the entire area is soaked to the full depth of each hole, unless otherwise noted in the drawings.

□□ Care shall be exercised always to protect the plants after planting. Any damage to plants by trampling or other operations of this Contract shall be repaired immediately.

□□ PRE-EMERGENT

□□ After soil preparation, planting and finish grade, Contractor shall apply a pre-emergent herbicide at manufacturer's recommended rate prior to placement of bark mulch in shrub and ground cover areas only.

□□ BARK MULCH

□□ Top Dressing (Ground Cover Areas): Apply 3" layer (9 yds. per 1,000 sq. ft.) of Shredded Cedar bark mulch in all planting areas. Do not apply bark top dressing on slopes if 2-1/2:1 or greater.

□□ Lawn seeding

□□ Overseed the lawn and cover with a thin layer of topsoil to fill depressions in the grade, protect the seed and maintain a moist environment for germination.

3.8 ROOT BARRIER INSTALLATION

□□ Install root barriers where trees are planted within 48 inches (48”) of paving or other hardscape elements such as walls, curbs, and walkways.

□□ Align root barrier adjacent to the paving or other hardscape element to protect from invasive roots.

□□ Install barrier continuously for 8’ in each direction from the tree trunk for an overall distance of 16’. If the trees are spaced closer, use a single continuous piece of root barrier.

□□ Position root barrier 2” below finish grade.

□□ Do not distort or bend root barrier during construction activities.

□□ Do not install root barrier surrounding the root ball of the tree.

3.9 CLEAN UP

□□ After all planting operations have been completed, remove all trash, excess soil, empty plant containers or rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. Clean-up contractor shall pick up all trash resulting from this work no less frequently than each Friday before leaving the site, once a week and/or the last working day each week. All trash shall be removed completely from the site. The Contractor shall leave the site area broom clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition. Condition acceptable to Owner and Architect.

3.10 OBSERVATION SCHEDULE

□□ Normal progress inspection shall be requested by the Contractor from the Architect at least 48 hours in advance of an anticipated site visit according to the indicated required observation schedule as follows:

□□ Final grade review, plant inspection – 48 hours

□□ Pre-maintenance – seven days

□□ Final walk-through – seven days

□□ No site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by the Owner. Failure to accomplish punch list tasks or prepare adequately for desired inspections shall make the Contractor responsible for reimbursing the Architect at his current billing rates per hour (plus transportation costs). No further inspections shall be scheduled until this charge has been paid and received.

3.11 START OF LANDSCAPE MAINTENANCE PERIOD

□□ The landscape Maintenance Period does not start until all work is installed as determined by the Architect, in writing.

□□ An on-site inspection by the Architect, Project Inspector and Owner is required to determine the date of the start of the Landscape Maintenance Period. The contractor must request the date and time of this on-site meeting 48 hours in advance. The contractor must also be in attendance.

□□ Work requiring corrective action or replacement, in the judgement of the Architect, shall be performed within ten days after final inspection. Corrective work shall be done at no additional cost to the Owner.

3.12 DURATION OF LANDSCAPE MAINTENANCE PERIOD

□□ The Landscape Maintenance Period shall continue for a minimum of 90 calendar days. During this time, the Contractor shall continuously maintain all areas involved in this Contract until final acceptance of the work by the Owner. Improper maintenance or possible poor condition of any planting at the termination of the scheduled maintenance period may cause postponement of the completion date of the Contract. Maintenance shall be continued by the Contractor until all work is acceptable. To carry out the plant maintenance work, the Contractor shall furnish sufficient men and adequate equipment to perform the work during the maintenance period.

□□ All planting areas shall be weeded. All planting and seeding shall be kept in a healthy growing condition by watering, weeding, cultivation, pruning, mowing, edging, spraying, fertilizing and by performing any other necessary operation of Maintenance. Failure to comply will result in an extension of the Landscape Maintenance Period, as determined by the Architect.

3.13 MAINTENANCE – SPRINKLER IRRIGATION SYSTEM

□□ The contractor shall check all systems weekly for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each end of the lateral. All heads are to be adjusted as necessary for unimpeded coverage.

□□ Set and program automatic controllers for seasonal water requirements. Give Owner's Representative a key to controllers and instructions on how to turn off system in case of emergency.

□□ Repair all damage to sprinkler irrigation system at Contractor's expense. Repairs shall be made within one watering period or one week, whichever is the shortest time.

3.14 MAINTENANCE – TURF AREAS

□□ Mowing of turf will commence when the grass has reached a height of 3". The height of cut will be 2". Mowing will be at least weekly after the first cut. Turf must be well-established and free of bare spots and weeds to the satisfaction of the Architect prior to final acceptance.

□□ All grass clippings shall be picked up and removed from the site and premises.

□□ Edges shall be trimmed at least twice monthly or as needed for a neat appearance. Clippings shall either be vacuumed or blown off walks.

□□ Lawns shall be watered at such frequency as weather conditions require replenishing soil moisture below root zone without drying out. Normally, a total of 1-1/2" of water is needed weekly in hot weather.

□□ Fertilize the lawn areas at the start of the Landscape Maintenance Period and every 30 days thereafter, with 16-6-8, at the rate of 6 lbs. per 1,000 sq. ft., unless otherwise directed.

3.15 MAINTENANCE – TREES AND SHRUBS

- Water enough that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
- Maintain and reconstruct water basins around plants as necessary.
- Do not prune unless directed to by Architect.
- Re-stake and re-tie trees as needed and as directed by the Architect.
- Replace any dead, dying, or vandalized plant material on a weekly basis throughout the maintenance period.

3.16 MAINTENANCE – INSECT AND HERBICIDE APPLICATION

- If needed, control weeds with selective herbicides and sprays. In areas where crabgrass has infested the lawn, apply pre-emergent herbicides such as Dacthal, Balan or Betasan for control prior to crabgrass germination. Control insect pests if necessary.
- Material, timing, rate of application and application shall be by a licensed Pest Control Operator.

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.
7. Section 03 30 00 - Cast-in-Place Concrete.

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 70 00 - Execution and 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. Section 01 50 50 - Temporary Facilities and Controls.

B. 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. Section 01 06 00 - Administrative Requirements: 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.
   3. Section 03 30 00 - Cast-In-Place Concrete.

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. Section 01 06 00 - Administrative Requirements: 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 Control: Testing and inspection services.

B. Field tests will be used to evaluate and approve cast-in-place concrete in accordance with Section 03 30 00.

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