



OXNARD COLLEGE

4000 S. Rose Ave., Oxnard, CA 93033

Oxnard College Occupational Education Building Alterations Project Manual

Date: 01/27/2026

DSA File No.: 56-C1
DSA Application No.: 03-124867

RRM Design Group
422 East Main St.
Ventura, CA 93001



RRM Project No.: 3244-01-ED24

Back of Front Cover



OXNARD COLLEGE

Oxnard College

Occupational Education Building Alterations

RRM Project Number: 3244-01-ED24

DSA File Number: 56-CI

DSA Application Number: 03-124687

Date: January 26, 2026
Owner: Ventura County Community College District
761 East Daily Drive, Suite 200
Camarillo, CA 93010

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

APP: 03-124867 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 03/12/2026

Architect and Consulting Engineers:

Martin Hartmann, Architect
RRM DESIGN GROUP
422 E. Main St.
Ventura, CA 93001
(805) 597-5292



Hugh A. McTernan, M.E.
AE GROUP MECHANICAL ENGINEERS
838 East Front Street
Ventura, CA 93001
(805) 653-1722



Jeffrey Thoma, E.E. THOMA ELECTRIC
3562 Empleo Street, Ste. C
San Luis Obispo, CA 93401
(805) 543-3850



EXPIRES: 09/30/26

Kenneth Lucci, EE Fire Alarm Engineer
Lucci & Associates, Inc.
3251 Corte Malpaso, #511
Camarillo, CA 93012-8094
(805) 389-6520



BLANK PAGE

Table of Contents

DIVISION 01 - GENERAL REQUIREMENTS

01 1000	SUMMARY
01 2000	PRICE AND PAYMENT PROCEDURES
01 2500	SUBSTITUTIONS
01 3119	PROJECT MEETINGS
01 3216	CONSTRUCTION PROGRESS SCHEDULE
01 3300	SUBMITTALS
01 4000	QUALITY CONTROL
01 4113	ADDITIONAL REQUESTS FOR DSA REVIEWED PROJECTS
01 5000	CONSTRUCTION FACILITIES & TEMPORARY CONTROLS
01 6000	PRODUCT REQUIREMENTS
01 6400	OWNER FURNISHED ITEMS
01 7135	RESTORATION OF IMPROVEMENTS
01 7329	CUTTING AND PATCHING
01 7419	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 7420	CLEANING
01 7700	CONTRACT CLOSEOUT

DIVISION 02 - EXISTING CONDITIONS

02 4100	DEMOLITION

DIVISION 03 - CONCRETE

03 0516	UNDERSLAB VAPOR BARRIER
03 1000	CONCRETE FORMING AND ACCESSORIES

03 2000 CONCRETE REINFORCING

03 3000 CAST-IN-PLACE CONCRETE

03 3511 CONCRETE FLOOR FINISHES

DIVISION 05 - METALS

05 1200 STRUCTURAL STEEL FRAMING

05 5000 METAL FABRICATIONS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 1000 ROUGH CARPENTRY

06 4100 ARCHITECTURAL WOOD CASEWORK

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 2100 BOARD AND BATT INSULATION

07 6200 SHEET METAL FLASHING AND TRIM

07 6500 FLEXIBLE FLASHING

07 8400 FIRESTOPPING

07 9200 JOINT SEALANTS

DIVISION 08 - OPENINGS

08 1113 HOLLOW METAL DOORS AND FRAMES

08 7100 DOOR HARDWARE

08 8000 GLAZING

DIVISION 09 - FINISHES

09 2116 GYPSUM BOARD ASSEMBLIES

09 2216 NON-STRUCTURAL METAL FRAMING

09 2236 LATH

09 2400 CEMENT PLASTERING

09 5100 ACOUSTICAL CEILINGS

09 6500 RESILIENT FLOORING

09 9113 EXTERIOR PAINTING

09 9123 INTERIOR PAINTING

DIVISION 10 - SPECIALTIES

10 1400 SIGNAGE

10 4400 FIRE PROTECTION SPECIALTIES

DIVISION 12 - FURNISHINGS

12 3600 COUNTERTOPS

DIVISION 22 - PLUMBING

22 0500 COMMON WORK RESULTS FOR PLUMBING

22 0510 PLUMBING PIPING

22 0523 GENERAL-DUTY VALVES FOR PLUMBING PIPING

**22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND
EQUIPMENT**

22 0700 PLUMBING INSULATION

22 4000 PLUMBING FIXTURES AND EQUIPMENT

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 0500 COMMON WORK RESULTS FOR HVAC

23 0529 HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC

23 0700 HVAC INSULATION

23 0802 AIR CLEANING

23 0922	CLIMATE MANAGEMENT CONTROL FOR HVAC
23 2300	REFRIGERANT PIPING
23 3000	SPLIT SYSTEM HEAT PUMPS
23 3113	METAL DUCTS
23 3300	AIR DUCT ACCESSORIES
23 3713	DIFFUSERS, REGISTERS, GRILLES, AND LOUVERS

DIVISION 26 - ELECTRICAL

26 0500	COMMON WORK RESULTS FOR ELECTRICAL
26 0501	SELECTIVE ELECTRICAL DEMOLITION
26 0519	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 0526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 0533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 0534	CABINETS
26 0553	IDENTIFICATION OF ELECTRICAL SYSTEMS
26 2416	PANELBOARDS
26 2726	WIRING DEVICES
26 5100	INTERIOR LIGHTING
26 5670	LIGHTING ACCEPTANCE TESTING
26 7700	ASSISTIVE LISTENING SYSTEM

DIVISION 26 – FIRE ALARM

26 0000	GENERAL PROVISIONS
26 0050	BASIC MATERIALS & METHODS
26 0111	CONDUITS

26 0120 CONDUCTORS

26 0130 ELECTRICAL BOXES

26 0190 SUPPORT DEVICES

**26 4721 AUTOMATIC EMERGENCY VOICE EVACUATION FIRE
ALARM SYSTEM**

DIVISION 27 - COMMUNICATIONS

27 1300 INTERCOMMUNICATION SYSTEMS

DIVISION 32 – SITE IMPROVEMENTS

32 1313 CONCRETE PAVING

BLANK PAGE

BLANK PAGE

Section 01 1000

Summary

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Oxnard College Occupational Ed Building Alterations
- B. District's Name: Ventura County Community College District
- C. Architect's Name: RRM Design Group.
- D. The Project consists of the alteration of an existing Occupational Education building on a community college campus. A portion of the building will be remodeled to create two classrooms, offices, storage, a wet prep room, a bookstore, and an aquarium. No additional floor area is proposed. Exterior alterations are limited to replacement of existing doors and creation of new openings in non-structural walls. Fire alarm system to be replaced in building.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price under a Competitively Bid Public Contract.

1.03 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of alterations work is indicated on drawings.
- B. HVAC: Alter and redistribute HVAC ductwork. No additional floor area.
- C. Electrical Power and Lighting: Redistribute existing lighting and power.
- D. Fire Alarm: No changes to fire alarm system.

1.04 OWNER OCCUPANCY

- A. District intends to continue to occupy classrooms, buildings and site facilities adjacent to the Project site during the entire construction period.
- B. District intends to occupy the Project by the date stated in the Agreement as the contract completion date.
- C. Cooperate with District to minimize conflict and to facilitate District's operations.
- D. Schedule the Work to accommodate District occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Arrange use of site and premises to allow:
 - 1. Owner occupancy and access to areas adjacent to Project site..
- B. Provide access to and from site as required by law and by District:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Time Restrictions:
 - 1. Limit conduct of especially noisy exterior work during the hours of instruction.
 - a. Instruction hours: Monday thru Friday 8:50am to 3:00pm .
 - 2. Limit delivery of materials during times of peak traffic on site as follows:.
 - a. Drop-off Monday: 9:25am to 9:45am.
 - b. Drop-off Tuesday thru Friday: 8:35am to 8:55am
 - c. Pick up Monday thru Friday: 2:45pm to 3:10pm
- D. Utility Outages and Shutdown:
 - 1. There shall be no disruption of utility services during hours of Instruction without notification to and prior authorization by District.
 - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to District and authorities having jurisdiction.
 - 3. Limit shutdown of utility services to non-instruction hours and at a time, arranged at least 24 hours in advance with District.
 - 4. Prevent accidental disruption of utility services to other facilities.
- E. Refer to 01 5000 Construction Facilities and Temporary Controls for additional information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**Section 01 2000
Price and Payment Procedures**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.

1.02 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Execute certification by signature of authorized officer.
- E. Submit one electronic and three hard-copies of each Application for Payment.

END OF SECTION

This page intentionally left blank

**Section 01 2500
Substitutions**

PART 1 - GENERAL

1.01 "OR EQUAL" SUBSTITUTIONS

- A. One Product Specified: Unless the Specifications state that no substitution is permitted, whenever in the Contract Documents any specific article, device, equipment, product, material, fixture, patented process, form, method, or type of construction is indicated or specified by name, make, trade name, or catalog number, with or without the words "or equal", such specification shall be deemed to be used for the purpose of facilitating description of material, process, or article desired and shall be deemed to be followed by the words "or equal". Contractor may, unless otherwise stated, offer any material, process, or article, which shall be substantially equal or better in every respect to that so indicated or specified and will completely accomplish the purpose of the Contract Documents.
- B. Two or More Products Specified: When two or more acceptable products are specified for an item of the Work, the choice will be up to the Contractor. Contractor shall utilize the same product throughout the Project. If a timely substitution request as set forth in Section 1.02.A. is not provided and an "or equal" substitution is requested, the District may consider the substitution only if the product specified is no longer commercially available.
 - 1. The burden of proof as to the equality of any material, process or article shall rest with the Contractor, and the Contractor shall submit all data substantiating a request for an "or equal" substitution item as provided in Section 3400 of the Public Contract Code, Specification Section 01 3300 and other specific sections of the specifications prior to Award of Contract.

1.02 REQUEST FOR SUBSTITUTIONS

- A. Substitute Request Form: Requests for substitutions of products, materials, or processes other than those specified must be made on the Substitution Request form attached. Requests must be submitted fourteen (14) calendar days prior to the date of the Bid Opening to be considered. An addendum will be issued seven (7) calendar days prior to Bid Opening, identifying all equipment and materials deemed equivalent to those specified and approved by the Architect.
- B. Substitution Request Content: A substitution request must constitute a representation that the subcontractor/general contractor:
 - 1. Has investigated proposed product and determined that it is equal in quality and serviceability of the specified item.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other work, which may be required for the work to be complete with no additional cost to General Contractor / Owner.
 - 4. Will be acceptable in consideration of the required design and artistic effect.
 - 5. Will require no excessive or more expensive maintenance including adequacy and availability of replacement parts.

6. Waives claims for additional costs or time extension, which may subsequently become apparent.
 7. Will reimburse District for review or redesign services by the Architect and re-approval fees by authorities, agencies, or the District.
- C. Substitution Submittal Procedure:
1. Contractor shall furnish copies of the requested information sufficient to determine whether the proposed substitution is equivalent including, but not limited to, all drawings, specifications, samples, performance data, calculations, and other information as may be required to assist the Architect, the District, and where required, DSA, in determining whether the proposed substitution is acceptable.
 2. The final decision shall be the District's. District may condition its approval of the substitution upon delivery to District of an extended warranty or other assurances of adequate performance of the substitution or upon approval by DSA in adequate time so as not to disrupt the project schedule.
 3. If the Substitution is Permitted: The Contractor shall be solely and directly responsible for fitting approved substituted material and equipment into the available space in a manner acceptable to the District and for the proper operation of the substituted equipment with all other equipment with which it may be associated. The Contractor shall bear all costs of meeting the above requirements for presenting a proposed substitution, and if the substitution is accepted, the Contractor must bear all costs involved including costs of Construction Manager's, Architect's, and Engineer's services required in adapting the substituted material or equipment to the installation to the complete satisfaction of the District including costs for processing through DSA when required.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SUBSTITUTION OF "OR EQUAL" PRODUCT

DATE:

COMPANY:

CONTACT PERSON:

ADDRESS:

TELEPHONE:

FAX:

PLAN SHEET:

SPECIFICATION SECTION:

LISTING OF PROPOSED "OR EQUAL" PRODUCTS:

BLANK PAGE

Section 01 3119

Project Meetings

PART 1 - GENERAL

1.01 PRECONSTRUCTION CONFERENCE

- A. Prior to commencement of work, a preconstruction conference will be held to discuss procedures to be followed during the progress of the work.
- B. Location: A convenient site for all parties designated by the District.
- C. Attending shall be:
 - 1. District's Representative
 - 2. Architect or Architect's designated representative.
 - 3. Contractor
 - 4. Contractor's Superintendent
 - 5. Major Listed Subcontractors
 - 6. Others subcontractors as appropriate
 - 7. Testing Lab and Inspection

1.02 LABOR COMPLIANCE PROGRAM MEETING

- A. Prior to commencement of work, a labor compliance conference will be held to discuss procedures to be followed during the progress of the work.
- B. Location: A convenient site for all parties designated by the District.
- C. Attending shall be:
 - 1. District's Representative
 - 2. Architect or Architect's designated representative.
 - 3. Contractor
 - 4. Contractor's Superintendent
 - 5. All Subcontractors
 - 6. Testing Lab and Inspection

1.03 PREINSTALLATION CONFERENCE

- A. Prior to commencement of the work listed below, a preinstallation conference will be held to discuss procedures to be followed during the progress of the work.
 - 1. Slab layout including location of plumbing and embed plates
 - 2. Irrigation system
 - 3. Sodding and plants
 - 4. Others as noted in individual specifications sections and/or requested by the District Representative

- B. Location: A convenient site for all parties designated by the District.
- C. Attending shall be:
 - 1. District's Representative
 - 2. Project Inspector
 - 3. Architect or Architect's designated representative
 - 4. Contractor's Project Manager
 - 5. Contractor's Superintendent
 - 6. Affected Subcontractors

1.04 PROPOSED PROGRESS MEETINGS

- A. Weekly progress meetings will be conducted by the Contractor.
- B. Location: Contractor's field office or via remote conference as agreed to by all parties
- C. Attending shall be:
 - 1. Project Inspector
 - 2. Contractor's Project Manager
 - 3. Contractor's Superintendent
 - 4. Subcontractors, as appropriate to the issues to be reviewed
 - 5. Suppliers, as appropriate to the issues to be reviewed
 - 6. Others, as appropriate to the issues to be reviewed
 - 7. District's Representative
 - 8. Architect or Architect's designated representative.
 - a. Consultants, as appropriate to the issues to be reviewed
- D. Contractor will take and distribute meeting notes to the attendees. Attendees taking exception to anything in the meeting notes shall state same in writing, directed to Contractor's Project Manager within five (5) working days following receipt of meeting notes.

1.05 BILLING MEETINGS

- A. As part of the last progress meeting each month, the Construction Manager may schedule and hold a billing meeting for the purpose of agreeing on the percentage of the work completed up to that date and establishing the amount to be requested in the Application for Payment.
- B. Location: Construction Manager's field office
- C. Attending shall be:
 - 1. Construction Manager
 - 2. District's Representative
 - 3. Contractor
 - 4. Architect or Architect's designated representative.
- D. Prepare an itemized draft of the month's proposed billing for review with the Project Team at the billing meeting.

- E. Following review of the proposed billing, revise as required, prepare Application for Payment, and submit to the Construction Manager. The Construction Manager will review, certify, and forward it to the District, who will authorize payment upon receipt of partial waivers of lien from the Contractor for previous payment, monthly certified payroll, and updated progress schedule.

**1.06 GUARANTEE/WARRANTIES, BONDS, AND SERVICE AND MAINTENANCE
CONTRACTS REVIEW MEETING**

- A. Eleven months following date of final completion and acceptance of the Owner, the Contractor shall arrange for and hold a meeting at the Project Site for the purpose of review of guarantees/warranties, bonds, and service and maintenance contracts for materials and equipment. Contractor shall notify the following attendees of the date and time at least seven (7) days in advance. Contractor shall take action as appropriate to implement repair or replacement of defective items, and to extend service and maintenance contracts.
- B. Attending shall be:
1. The District's Representative
 2. Construction Manager
 3. Architect or Architect's designated representative.
 4. Contractor
 5. Subcontractors, as appropriate to the agenda
 6. Suppliers, as appropriate to the agenda
 7. Others, as appropriate to the agenda

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED.

End of Section

This page intentionally left blank

**Section 01 3216
Construction Progress Schedule**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work under this section shall consist of furnishing computerized Critical Path Method (CPM) contract schedule showing in detail how the Contractor plans to execute and coordinate the work.

1.02 SUBMITTALS

- A. CPM Contract Schedule
 - 1. Within seven (7) calendar days after receiving Notice to Proceed, Contractor shall furnish the District's Representative and Architect each an electronic PDF and two (2) prints of a CPM contract schedule (four copies total).
 - 2. District's Representative will review the CPM contract schedule for conformance with the requirements of the contract. Within seven (7) calendar days after receipt, District's Representative will accept the CPM contract schedule or will return it with comments. If the proposed CPM contract schedule is not accepted, Contractor shall revise the schedule to incorporate comments and resubmit the schedule for acceptance within seven (7) calendar days after receiving it.
- B. Construction Progress Schedule
 - 1. Contractor shall submit to the Architect and District's Representative each month an up-to-date status report of the work.

1.03 GENERAL REQUIREMENTS

- A. The contract schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. The responsibility for developing the contract schedule and monitoring actual progress as compared to the schedule rests with the Contractor.
- B. Failure of the contract schedule to include any element of the work, or any inaccuracy in the contract schedule, will not relieve the Contractor from responsibility for accomplishing all the work in accordance with the contract.
- C. No constraint on any activity is allowed in the schedule unless it is required by the contract. The schedule should reflect a logical flow of the project activities.
- D. Acceptance of the official contract schedule will not relieve the Contractor of the responsibility for accomplishing the work in accordance with the contract.

1.04 CONSTRUCTION PROGRESS SCHEDULE

- A. The Contractor's monthly Construction Progress Schedule report shall include:

1. Contractor's estimated percentage complete for each activity not yet completed.
 2. Actual start/finish dates for activities as appropriate.
 3. Identification of processing errors, if any, on the previous update reports.
 4. Revisions, if any, to the assumed activity durations, including revisions for weather impact, for any activities due to the effect of the previous update on the schedule.
 5. Identification of activities which are affected by Cost Request Bulletin issued during the update period.
 6. Resolution of conflict between actual work progress and schedule logic. When out-of-sequence activities develop in the contract schedule because of actual construction progress, the Contractor shall submit a revision to schedule logic to conform to current status and direction.
- B. Progress payments pursuant to the contract will require an update of the construction progress schedule.

1.05 SHORT INTERVAL SCHEDULE:

- A. Short Interval Scheduling (SIS) may be used throughout the on-site construction activity.
- B. The interval shall be a three (3) week projection and shall include the week submitted and two (2) weeks thereafter.
- C. It shall contain sufficient detail to evaluate daily milestones and manpower/equipment loading, and shall identify/tie into the monthly updated contract schedule.
- D. Short interval schedule shall be approved by the Construction Manager and District's Representative.
- E. Short interval schedule shall be submitted weekly.
- F. During the weekly construction meeting, the District Representative and the Contractor will review and discuss short interval schedules.

1.06 SCHEDULE REVISIONS

- A. Should the Contractor, after acceptance of the contract schedule, intend to change his plan of construction, the Contractor shall submit his requested revisions to the District's Representative along with a written statement of the revision; including a description of the logic for rescheduling the work, methods of maintaining adherence to intermediate milestones, and other specific dates and the reasons for the revisions. If the requested changes are acceptable to the District's Representative, they will be incorporated into the contract schedule in the next reporting period.
- B. Schedule revisions shall be submitted at least seven (7) calendar days prior to the date of submission of update information. The District will have seven (7) calendar days to review the revisions.
- C. If the sequence of construction differs significantly from the contract schedule, as determined by the District's Representative, the Contractor shall submit within fifteen (15) calendar days a revised schedule to the District's Representative for acceptance.

1.07 SCHEDULE CHANGES

- A. When a Cost Request Bulletin is issued which has the potential to impact specified completion dates, a network window shall be prepared by the Contractor to reflect the impact of such changes, said network window shall be submitted to the District's Representative. After the network window has been accepted, by the District's Representative, and the Contractor ordered to proceed with the Cost Request Bulletin, it shall be incorporated into the contract schedule. Time extensions will be considered only to the extent there is insufficient remaining float to accommodate these changes, and pursuant to Part 1 of these specifications. No additional cost beyond that provided in the General Conditions will be allowed for the incorporation of approved Cost Request Bulletin into the contract schedule.
- B. The Contractor shall submit to the Architect and District's Representative, a network window for all claimed time extension requests showing the impact of claimed delay on the contract schedule. Time extensions shall be negotiated per the requirements of the General Conditions.
- C. Float or Slack Time is the amount of time between the earliest start date and the late start date or between the earliest finish date and the latest finish date of activities of the contract schedule. No time extensions or delay costs will be allowed for delays caused by the District, on paths or activities containing float time, providing such delay does not exceed the float time per the latest updated version of the contract schedule.
- D. The District's Representative shall have no obligation to consider any time extension request unless the requirements of the contract documents are complied with; the District shall not be responsible or liable to the Contractor for any construction acceleration due to failure of the District to grant time extensions under the contract documents should the Contractor fail to substantially comply with the submission requirements and the justification requirements of this contract for time extension requests. The Contractor's failure to perform in accordance with the contract schedule shall not be excused because the Contractor has submitted time extension requests; until, and unless, such requests are approved by the District.

1.08 RECOVERY SCHDEULE:

- A. If the contract schedule falls fourteen (14) calendar days behind schedule on milestone dates or completion dates, the Contractor shall be required to prepare and submit a Recovery Schedule to the District's Representative, with form and detail appropriate to the need to explain, and display, how they intend to reschedule activities to regain compliance with the contract schedule during the immediate subsequent pay period.
- B. Upon acceptance by the District's Representative, the recovery schedule shall be incorporated into the contract schedule by the Contractor.

1.09 PAYMENTS WITHHELD:

- A. Progress payments may be withheld in whole or in part should the Contractor fail to comply with the requirements of this section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Section 01 3300

Submittals

PART 1 - GENERAL

1.01 DESCRIPTION

- A. To ensure that specified products are furnished and installed in accordance with plans and specifications, transmittal procedures have been established for submittals for review by the Construction Manager, the Architect, and the Owner.
- B. Make all following submittals in strict accord with provisions of this Section and with requirements of the General Conditions:
 - 1. Progress Schedule.
 - 2. Schedule of Values
 - 3. Safety Plan
 - 4. Certificates
 - 5. Shop Drawings.
 - 6. Descriptive Data/Material Lists.
 - 7. Samples.
 - 8. Test Reports
 - 9. Alternatives (Substitutions).
 - 10. Project Record Documents
- C. Electronic Data Transfer Agreement

1.02 RELATED REQUIREMENTS

- A. General Conditions.
- B. Section 01 3216 - Construction Progress Schedule
- C. Section 01 7700 - Contract Closeout:
- D. Test Reports: Pertinent Specification Sections.
- E. Test Reports: Pertinent Specification Sections.

PART 2 - PRODUCTS

2.01 PROGRESS SCHEDULE

- A. Prepare and submit progress schedule of procurement and fabrication activities, and component deliveries as required by Section 01 3216 and within the time of completion identified in Notice to Bidders.

2.02 SHOP DRAWINGS

- A. Submittals shall be in electronic format (PDF) and include name and location of project, name of Contractor, and contract numbers and cross references to contract documents. Number shop drawings consecutively. Make drawings legible and complete in every respect. Refer to General Conditions.
- B. If shop drawings show variations from Contract requirements because of standard shop practice or other reason, make specific mention of such variations in letter of transmittal, as well as on drawings, in order that (if acceptable) suitable action may be taken for proper adjustment of Contract. Unless specific changes have been noted and accepted, no deviations from Contract Documents will be permitted.

2.03 PRODUCT DATA/MATERIAL LISTS

- A. Manufacturer's Standard Schematic Drawings:
 - 1. Modify drawings to delete information, which is not applicable to Project.
 - 2. Supplement standard information to provide additional information applicable to Project.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data:
 - 1. Clearly mark each copy to identify pertinent materials, products, or models.
 - 2. Show dimensions and clearances required.
 - 3. Show performance characteristics and capacities.
 - 4. Show wiring diagrams and controls.
 - 5. Include calculations when applicable.
- C. Electronic submittal of product data in pdf format, unsecured, is acceptable.

2.04 SAMPLES

- A. Where required by the specifications and by change orders, the Contractor shall provide at no additional cost:
 - 1. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.
 - 2. Where size of samples is not specified, office samples should be of sufficient size and quantity to clearly illustrate:
 - a. Functional characteristics of product or material, with integrally related parts and attachment devices.
 - 1) After review, samples may be used in construction of project.

PART 3 - EXECUTION

3.01 SUBMISSION REQUIREMENTS

- A. Schedule submissions at least four weeks before dates reviewed submittals will be needed. Some submissions may be required to be submitted even earlier.
- B. Identification: Identify all submittals with names and location of project, name of Contractor and contract numbers.
 - 1. Submittals shall be accompanied by letter of transmittal addressed to Construction Manager following format and procedures established at the Preconstruction Conference.
 - 2. Each submittal shall be numbered by product 2-digit Specification Division and 4-digit Specification Section number and shall contain list of items submitted, properly identified as to drawing and/or page numbers.
 - 3. Digital submittals more than 10 pages in length shall be bookmarked or tabbed by each product component included for review in the submission for ease of reference.
 - 4. Submittals not adequately identified and bookmarked will be returned to Contractor for correction and resubmittal.
- C. Architect will review submittals for conformance with Contract Documents and acceptance by Architect covers only such conformance. Responsibility for accuracy and correction and resubmittal shall be the Contractor's.
- D. Acceptance of submittals will be general and shall not relieve Contractor from responsibility for proper fitting and construction of work, nor from furnishing materials and work required by Contract, which may not be indicated on submittals.
- E. No portion of work requiring submittals that affect the construction shall be commenced until submittal has been reviewed and accepted by Architect. All such portions of work shall be in accordance with accepted submittals.
- F. Number of copies required by Architect: Electronic PDF's are acceptable and preferred in lieu of hard copies. Only provide hard copies as follows if information is unable to be digitized.
 - 1. Schedule of Values: Two (2) copies AIA form G107 with back up sheets.
 - 2. Certification: Three (3) copies
 - 3. Samples: As specifically indicated in pertinent Specification Section.
 - 4. Samples for Color/Pattern Selection. Three (3) sets of manufacturer's complete range for initial selection: and additional samples as requested of selected color/pattern for inclusion in final color schedule.
 - 5. Alternatives: Three (3) copies of all required related data and information.

3.02 SUBMITTALS SHALL INCLUDE (WHERE APPLICABLE):

- A. Date and revision dates.
 - 1. Project title and work order number.
 - 2. Names of Contractor, subcontractor and supplier or manufacturer.
 - 3. Identification of product or material.

4. Relation to adjacent structure or material.
5. Field dimensions, clearly identified as such.
6. Specification Section number.
7. Consecutive submittal number.
8. Blank space for Architect's stamp and approving agency as required.
9. Contractor's stamp, initialed or signed, certifying review of submittal, verification of field measurements and compliance with Contract Documents.

END OF SECTION

**Section 01 4000
Quality Control**

PART 1 - GENERAL

1.01 DEFINITIONS

- A. Soils Engineer and Testing Laboratory: The District will retain a qualified soils engineer and testing laboratory to perform tests and report on work as specified in the contract documents, and as otherwise required.
- B. Testing Agency: An organization other than the testing laboratory, retained and paid by the District to perform tests and report on whether or not designated items of work comply with the requirements of the contract documents.

1.02 TESTS

- A. The District will select an independent testing laboratory to conduct the tests. Selection of the material required to be tested shall be by the laboratory or the District's representative and not by the Contractor.
- B. The Contractor shall notify the District's representative a sufficient time in advance of the manufacture of material to be supplied by him under the contract documents, which must by terms of the Contract be tested, in order that the District may arrange for the testing of same at the source of supply.
- C. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.
- D. The District will select and pay testing laboratory costs for all tests and inspections, but may be reimbursed by the Contractor for such costs under the contract documents.

1.03 TESTING LABORATORY

- A. General: Services of a testing laboratory are required for work specified in various individual specification Sections.
- B. Contractor Responsibilities:
 - 1. Contractor shall cooperate with testing laboratory personnel.
 - 2. Furnish copies of product test reports as specified.
 - 3. Furnish incidental labor and facilities:
 - a. To provide access to work to be tested
 - b. To obtain and handle samples at the project site or at the source of the product to be tested as requested by the testing lab
 - c. To facilitate inspections and tests

- d. To facilitate storage and curing of test samples
- e. To fabricate testing samples as indicated

1.04 TEST REPORTS

- A. The testing laboratory will distribute reports as follows:
 - 1. Construction Manager (1 copy)
 - 2. Architect (1 copy)
 - 3. Applicable Consultants (1 copy each)
 - 4. State Agencies as appropriate
 - 5. District's Project Inspector
- B. The Owner shall distribute reports in the same manner and number as for the testing laboratory.

1.05 RETESTING

- A. The District Representative shall have the right to order additional tests as instructed if he has reasonable doubt that materials comply with Specification requirements.
 - 1. If additional tests establish that materials comply with Specification requirements, costs for such tests will be paid by the District.
 - 2. If additional tests establish that materials do not comply with Specification requirements, costs for such retests shall be paid by the Contractor.

1.06 INSPECTION BY THE DISTRICT

- A. The District and Architect shall, at all times, have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- B. The District and Architect shall have the right to reject materials and quality of work, which are defective, or to require their correction. Rejected work quality shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the District. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the District may correct same and charge the expense to the Contractor.
- C. Should it be considered necessary or advisable by the District or Architect, at any time before final acceptance of the entire work to make an examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

1.07 PROJECT INSPECTOR - DISTRICT'S

- A. A Project Inspector retained by the District in accordance with the requirements of the California Code of Regulations, Title 24, will be assigned to the work. His duties are

specifically defined in Title 24, Part I, Sec. 4-342.

- B. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Project Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Project Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.
 - 1. Submit qualifications of observer to Architect 30 days in advance of required observations.
 - 2. Observer subject to approval of District.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

Section 01 4113
ADDITIONAL REQUIREMENTS FOR DSA REVIEWED PROJECTS

PART 1 GENERAL

TITLE 24 COMPLIANCE

- A. All work shall comply with Title 24, Parts 1 through 6, and 8 through 11.
- B. All copies of Title 24, Parths 1 through 5 shall be kept on site during construction.

1.02 DSA DEFERRED APPROVALS

- A. Refer to Contract Drawings

1.03 INSPECTION AND SUPERVISION

- A. Supervision by DSA shall be in accordance with Section 4-334 of Part 1, Title 24, CCR.
- B. District shall employ a full-time Project Inspector approved by DSA. The Project Inspector shall observe construction in accordance with Section 4-333(b) and 4-342 of Part 1, Title 24, CCR.
- C. Reports: Project Inspector shall submit the following in accordance with DSA IR A-7.
 - 1. Start of Project Report: Notify DSA of start of construction in accordance with Section 4-331 of Part 1, Title 24, CCR.
 - 2. Semi-Monthly Reports: Comply with Section 4-337 of Part 1, Title 24, CCR.
 - 3. Verified Reports: Comply with Section 4-336 of Part 1, Title 24, CCR.
- D. Special Inspection Requirements:
 - 1. Comply with Section 4-333(c) of Part 1, Title 24, CCR.
 - 2. Special inspection costs are to be paid by the District.
 - 3. Conduct special inspection as per Statement Structural Tests and Special Inspections DSA-103.

1.04 TESTING LABORATORY REQUIREMENTS

- A. Comply with Section 4-335 of Part 1, Title 24, CCR.
- B. The Owner shall select the testing Laboratory approved by DSA, Architect, and Structural Engineer.
- C. Sampling and testing shall be performed by properly qualified persons in accordance with American Society for Testing and Materials (ASTM) standards.
- D. Conduct tests as per Statement Structural Tests and Special Inspections DSA-103.

- E. Submit one copy of test reports to DSA.

1.05 ADDENDA AND CHANGE ORDERS

- A. Comply with Section 4-338 of Part 1, Title 24, CCR.
- B. Comply with DSA IR A-6.
- C. DSA approval is required for changes to code-regulated construction and inspection/testing functions prior to start of that work. Code-regulated construction refers to work that is regulated by code provisions applicable to public school construction, including those adopted by DSA Structural Safety (DSA/SS), DSA Access Compliance (DSA/AC) and State Fire Marshal (SFM).
- D. All substitutions affecting DSA regulated items shall be considered as a Construction Change Document (CCD) or Addenda.
- E. All Addenda must be signed by the Architect or Engineer of Record in general responsible charge and approved by DSA per Section 4-338 of Part 1, Title 24, CCR.
- F. All CCD's must be signed by the Architect or Engineer of Record, Structural Engineer (when applicable), Delegated Professional Engineer (when applicable), and DSA per Section 4-338 of Part 1, Title 24, CCR.
- G. Do not begin any work under addendum or change order until required DSA written approval is obtained.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**Section 01 5000
Construction Facilities & Temporary Controls**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Sanitary facilities, including drinking water and washing facilities.
 - 4. Storm and sanitary sewer.
- C. Support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds.
 - 2. Temporary enclosures.
 - 3. Waste disposal services.
 - 4. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, and lights.
 - 3. Enclosure fence for the site.
 - 4. Environmental protection.

1.02 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, fire department, and rescue squad rules.
 - 5. Environmental protection regulations.
- B. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.03 STANDARDS - COMPLY WITH THE FOLLOWING LISTED STANDARDS

- A. NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations
- B. ANSI A10 Series standards for "Safety Requirements for Construction and Demolition

- C. NECA Electrical Design Library "Temporary Electrical Facilities
- D. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
- E. NFPA 10 "Standard for Portable Fire Extinguishers"
- F. NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1.04 SUBMITTALS

- A. Construction Site Plan: Provide plan showing proposed locations of temporary site constructions including temporary utilities, construction facilities, construction fencing and gates, and laydown areas.

1.05 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chain link fabric fencing 6 feet (2 m) high and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

2.02 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

- C. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- D. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- E. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Provide self contained washing facilities, stocked with soap, disposable towels, and drinking cups; Use only potable water in Health Dept. approved containers.
- F. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: As required to complete the work of the contract, engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Obtain easements to bring temporary utilities to the site where the District's easements cannot be used for that purpose.
 - 3. Use Charges: Cost or use charges for temporary facilities are not chargeable to the District or Architect. Neither the District nor Architect will accept cost or use charges as a basis of claims for Change Orders.

- B. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switchgear.
 - 1. Install electric power service underground, except where overhead service must be used.
 - 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- C. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs. Maintain service until District allows use of permanent facilities.
 - 1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
- D. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

3.03 SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
 - 1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Furnish and equip offices as follows:
 - 1. Furnish with plan layout table and storage space for project documents and submittals.
- C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
- D. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- D. Enclosure Fence: Before excavation begins, install a minimum six foot tall enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
- E. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth or portable fencing, if appropriate, with sufficient hold down weight to prevent overturning. Portable fence post bases shall not extend into adjacent walkways.
- F. Provide visual screening of the construction site from specific areas if required by District.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- H. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- I. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and

minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

- J. Storm Water Protection: Provide rumble strips, straw waddles, silt fences or other measures as required to provide protection of storm water. Comply with all regulations for the protection of storm water resources.

3.05 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Maintain site as described in Section 01 7420 Cleaning, including sweeping up dirt and debris blown or tracked off site.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
 - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
 - 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

END OF SECTION

**Section 01 6000
Product Requirements**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Substitution limitations.
- D. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements: Product quality monitoring.
- B. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the District; notify District promptly upon discovery; protect, remove, handle, and store as directed by District.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the District, or otherwise indicated as to remain the property of the District, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing asbestos
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. Have longer documented life span under normal use.

2. Result in less construction waste. See Section 01 7419

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.02 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Do not store products directly on the ground.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

This page intentionally left blank

**Section 01 6400
Owner Furnished Items**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: District Furnished Items and installed by the Contractor.

1.02 PROCEDURES

- A. Contractor shall coordinate delivery schedule with District
- B. Contractor shall make arrangements with ODistrict to ascertain required arrangements for warehousing, delivery to Project site, and installation.
- C. Contractor shall be responsible for District-furnished products when they are delivered to the site or are turned over by the District's vendor or distributor.
- D. Contractor's warranty for District-furnished items shall be limited to installation only.

PART 2 - PRODUCTS

2.01 OWNER-FURNISHED ITEMS/CONTRACTOR INSTALLED ITEMS (OFCI)

- A. Item includes:
 - 1. All equipment listed in schedule on drawing sheet A-401. (Contractor Installed)
 - 2. Overhead projectors (Contractor Installed)
 - 3. White boards (Contractor Installed)

2.02 OWNER-FURNISHED/OWNER INSTALLED ITEMS (OFOI)

- A. Items includes:
 - 1. None.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install each item in accordance with manufacturer's instructions, specified and shown.
- B. Coordinate with other trades. Provide back plates and connections.
- C. Each item shall be fully functional and operable after installation.

- D. Correct work performed that does not meet technical or design requirements at no cost to the District.

END OF SECTION

**Section 01 7135
Restoration of Improvements**

PART 1 - GENERAL

1.01 STRUCTURES

- A. The Contractor shall carefully cut and or remove such existing structures, utilities, and improvements as required to complete the work, including but not limited to: curbs, gutters, pipelines, sidewalks and utility poles, as may be necessary for the performance of the work and shall rebuild the structures thus removed in as good a condition as found. The Contractor shall also repair existing structures or improvements, which may be damaged as a result of the work under this contract.

1.02 ROADS AND STREETS

- A. Unless otherwise specified, roads and streets in which the surface is removed, broken, or damaged, or in which the ground has caved or settled during the work under this contract, shall be resurfaced and brought to the original grade and section by the Contractor. Roadways used by the Contractor shall be cleaned and repaired to Local, County, and State Standards. Before resurfacing material is placed, edges of pavements shall be trimmed back far enough to provide clean solid, saw-cut vertical faces, and shall be free of loose material.

1.03 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS

- A. Cultivated or planted areas and other surface improvements which are damaged by actions of the Contractor shall be restored to their original condition or better.
- B. Existing guard posts, barricades, and fences shall be protected and replaced if damaged.
- C. Special attention shall be given to avoid trees, bushes and shrubs not indicated for removal.

1.04 PROTECTION OF EXISTING INSTALLATIONS

- A. The Contractor shall immediately correct or replace existing equipment, controls or systems that are damaged as a result of their operations.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

This page intentionally left blank

Section 01 7329
Cutting and Patching

PART I - GENERAL

1.01 SECTION INCLUDES

- A. Procedures for cutting and patching as may be required to complete the work of this project.

1.02 RELATED SECTIONS

- A. Section 01 5000 - Construction Facilities and Temporary Controls
- B. Section 01 7135 - Restoration of Improvements
- C. Section 01 7420 - Cleaning
- D. Section 01 7419 - Construction Waste Management & Disposal
- E. Section 320505 - Selective Demolition for Exterior Improvements

1.03 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.

1.04 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load-deflection ratio.
- B. 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.
- C. Miscellaneous Elements: Do not cut or 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.
- D. Visual Requirements: Do not cut or patch 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.

PART 2 - PRODUCTS

2.01 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

3.01 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.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- 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 prevent interruption to occupied areas.

3.03 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. Proceed with patching after construction operations requiring cutting are complete.
 - 3. When possible, cut along existing control joints and score lines.
- 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.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

This page intentionally left blank

**Section 01 7419
Construction Waste Management and Disposal**

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. District requires that this project generate the least amount of trash and waste possible with the goal of diverting 65% of waste from the landfill.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
 - 6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
- E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.
- F. Develop and follow a Waste Management Plan designed to implement these requirements.
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 3300 - Submittals: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7329 - Cutting and Patching: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.

- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- B. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to District.
 - 3. Landfill Disposal: Include the following information:
 - a. Identification of material.

- b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
- 4. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
- 5. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
- 6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. Waste management and diversion goals may be achieved by the following methods:
 - 1. Roll Off Waste Container: Contractor may hire a company which provides a roll off waste container which is then sorted off site.
 - 2. On Site Sorting: Contractor to sort waste on site.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, District, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.
 - 2. Preconstruction meeting.
 - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

This page intentionally left blank

Section 01 7420

Cleaning

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cleaning throughout the construction period, and final project cleaning prior to the acceptance tour.

1.02 RELATED SECTIONS

- A. Section 01 5000 - Construction Facilities and Temporary Controls

1.03 QUALITY ASSURANCE

- A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.
- B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

- A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY

- A. Use cleaning materials and equipment that are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

PART 3 - EXECUTION

3.01 PROGRESS CLEANING

- A. General:
 - 1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work. Debris shall be removed from the site and disposed of in a lawful manner. Disposal receipts or dump tickets shall be furnished to Architect

- upon request.
 - 3. At least twice each month, and more often if necessary, remove scrap debris, and waste material from the job site.
 - 4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.
- B. Site:
- 1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove items to the place designated for their storage. Flammable waste shall be kept in sealed metal containers until removed from the site.
 - 2. Weekly, and more often if necessary, inspect, arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.
 - 3. Maintain the site in a neat and orderly condition.
- C. Structures:
- 1. Weekly, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.
 - 2. Weekly, and more often if necessary, sweep interior spaces clean.
 - a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom, i.e., "broom-clean".
 - 3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.
 - 4. Following the installation of finish floor materials, clean the finish floor daily, and more often if necessary, and while work is being performed in the space in which finish materials have been installed.
 - a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material that, in the opinion of the Architect, may be injurious to the finish floor material, i.e., "vacuum-clean".
- D. General: The General Conditions require general cleaning during construction. Prior to completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described below.
- E. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Unless otherwise specifically directed by the Architect, water and broom clean paved areas on the site and public paved areas directly adjacent to the site. Remove resultant debris
- F. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
- 1. Remove labels that are not permanent labels.
 - 2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

- G. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Sweep and mop vinyl and rubber surfaces.
- H. Structures:
 - 1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.
 - 2. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the District.
- I. Interior: In areas affected by the work under this contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.
- J. Glass: Clean glass inside and outside.
- K. Polished surfaces: On surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer
 - 1. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - 2. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
- L. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.
- M. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- N. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the District's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
- O. Extra Materials: Where extra materials of value remain after completion of associated Work, they become the District's property. Dispose of these materials as directed by the Owner.
- P. Timing: Schedule final cleaning as accepted by the Architect to enable the District to accept a completely clean project.

Q. Cleaning During District's Occupancy

1. Should the District occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the District, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accordance with the General Conditions of the Contract.

END OF SECTION

**Section 01 7700
Contract Closeout**

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Closeout Procedures.
- B. Project Record Documents.
- C. Operation and Maintenance Data.
- D. Guaranties, Warranties, Bonds and Waivers.
- E. Spare Parts and Maintenance Materials.

1.02 RELATED REQUIREMENTS

- A. General Conditions: Fiscal provisions, legal submittals and other administrative requirements.
- B. Section 01 1100 - Summary of Work
- C. Section 01 3300 - Submittals
- D. Section 01 7135 - Restoration of Improvements
- E. Section 01 7420 - Cleaning

1.03 PRELIMINARY PROCEDURES

- A. Comply with procedures stated in General Conditions of the Contract.
- B. When Contractor considers work has reached substantial completion, submit written certification that work is ready for inspection.
- C. Before requesting an inspection for final completion, complete the following and note any exceptions:
 - 1. In the Application for Progress Payment that coincides with, or first follows, the date final completion is claimed, show 100 percent completion for the work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated and an accounting of changes to the Contract Sum
 - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise the District of pending insurance changeover requirements.

3. Changeover to permanent keying including advising District of changeover in security provisions.
 4. Submission of closeout submittals as specified in Section 1.05 below.
 5. System startup and instructions to District's personnel.
 6. Disconnection and removal of temporary facilities, mockups, and tools.
 7. Final cleanup.
- D. The Contractor shall "pre-punch list" its own work and work of subcontractors. A "Zero Punchlist" approach is expected on this Project.
1. Contractor shall plan to ensure work tasks are completed correctly and expeditiously the first time.
 2. Contractor shall recognize quality issues and correct defective work as soon as possible to minimize interference with other work ongoing and impact on the Construction Schedule.
- E. When Contractor considers the Work or a designated portion of the Work is complete, an inspection to determine acceptance of the Project will be performed by the Architect, District, and District's Project Inspector.
- F. If the Architect determines there are items to be performed, corrected, or completed before the Project will be accepted, it will attach a "punch list" listing and describing these items.
- G. The Architect's "punch list" work shall be completed within thirty days, unless otherwise mutually agreed, and prior to acceptance of the Project by the Architect and District.
1. Exceptions:
 - a. Change Order work that is approved too late to be completed by the Contract completion date
 - b. Warranty work

1.04 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Each trade/subcontractor responsible for installation shall be responsible for and not limited to the following:
1. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to final application for payment inspection.
 2. Remove unused or temporary underground utilities or installations completely.
 3. Clean and repair damage caused by installation or use of temporary work.
 4. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.05 PROJECT RECORD DRAWINGS AND SPECIFICATIONS

- A. General
1. Maintain, on daily basis, Record Drawings showing "as-built" condition of project; subject to monthly review by Architect, Project Inspector, or District.
 2. Store documents separate from those used for construction.
 3. At time of installation, installed locations of all work relating to above and underground utilities, architectural, structural, heating, ventilation, air conditioning, plumbing, electrical, and other scopes of work as may be required, shall be recorded on prints

- maintained at the jobsite by Contractor, and reviewed with the Project Inspector. Do not conceal work until required information is recorded.
4. The Contractor will make available jobsite as-builts or provide scans or photographs of recorded information for Architect or District review as requested.
 - a. All information entered on reproducible prints shall be neat, legible, and emphasized by drawing "clouds" around changed items.
 - b. Locate and dimension all work, including stubs for future connections, with reference to permanent landmarks or buildings and indicate approximate depth below finish grade.
 - c. Symbols and designations used in preparing Record Drawings shall match those used in Contract Drawings.
 5. Prior to final inspection, submit project record documents with transmittal letter containing date, project title, Contractor's name and address, list of documents and signature of Contractor.
 - a. Failure of the Contractor to comply with this section in total or in part may constitute reason for the withholding of all or part of the monthly progress payment due the Contractor for that month.
 6. Prior to processing the Contractor's monthly payment request, Project Inspector, Architect, or District's Representative will meet with the Contractor to review and verify that the Record Documents have been updated.
 7. Label and date each Record Drawing "RECORD DOCUMENT" in legibly printed letters.
- B. Record Drawing Information:
1. Record the following information:
 - a. Locations of work buried under or outside each building, such as plumbing and electrical lines and conduits.
 - b. Actual numbering of each electrical circuit.
 - c. Locations of significant work concealed inside each building whose general locations are changed from those shown on the Contract.
 - d. Locations of all items, not necessarily concealed, which vary from the Contract Documents.
 - e. Installed location of all cathodic protection anodes.
 - f. Deviations from the sizes, locations and other features of installation shown in the Contract Documents.
 - g. Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stubouts, invert elevations, etc.
 - h. Sufficient information to locate work concealed in each building with reasonable ease and accuracy; in some instances, this may be by dimension. In others, it may be in relation to the spaces in the building near which it was installed.
 2. Provide additional drawings as necessary for clarification.
- C. Record Specifications
1. District's Representative will provide Contractor with one (1) set of Contract Specifications, which shall be labeled "Record Document" in legible letters.
 2. Mark each section legibly to record manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

1.06 OPERATION AND MAINTENANCE DATA

- A. Provide data for other Sections as required by the Contract Documents.
- B. Submit two sets prior to final inspection, bound in 8-1/2 x 11 inch three ring side binders with durable plastic covers; with identification on, or readable through, front cover stating general nature of manual.
- C. Provide a separate volume for each system, with a table of contents and index tabs for each volume; all material neatly typewritten; each volume containing:
 - 1. Part 1: Directory, listing names, addresses and telephone numbers of District's Representative, Contractor, and relevant Sub-Contractors; and index furnishing complete information as to location in manual of all emergency data regarding installation.
 - 2. Part 2: Operation and maintenance instructions, arranged by system. For each system, give names, addresses and telephone numbers of subcontractors and suppliers; and include the following:
 - a. List of equipment.
 - b. Parts list; including complete nomenclature and names and address of nearest vendor of parts.
 - c. Detailed operating instructions.
 - d. Maintenance instructions, equipment, including routine maintenance cards with time frequency of routine maintenance noted.
 - e. Maintenance instructions, finishes.
 - f. Shop drawings and product data, including changes made during construction.
 - g. Copies of Guaranties/Warranties.
- D. Extraneous Data: Where contents of manuals include manufacturers' catalog pages, clearly indicate precise items included in this installation and delete, or otherwise clearly indicate, all manufacturer's data with which this installation is not concerned.
- E. Final inspection will not be scheduled until all maintenance/operating manuals are delivered to the District Representative.
- F. Contractor will be responsible for training of District's personnel for operation of all building systems. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

1.07 GUARANTIES, WARRANTIES, AND BONDS

- A. Standard Guarantee: Guarantee all work executed under this Contract to be free of all defects of work quality and materials for a period of one (1) year after completion and acceptance by the District. Refer to General Conditions and to other specific product and installation warranties listed in individual sections.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS EXTRA STOCK

- A. Provide products, spare parts, and maintenance materials in guaranties specified in each section, in addition to that used for construction of work. Coordinate with the Construction Manager and deliver to project site. Provide with a detailed transmittal and obtain receipt prior to final payment.

1.09 FINAL ADJUSTMENT OF ACCOUNTS

- A. Application for Final Payment shall be made in accordance with the General Conditions reflecting all adjustments to the Contract Sum as follows:
 - 1. The original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders
 - b. Deductions for uncorrected Work.
 - c. Other adjustments
 - 3. Total Contract Sum, as adjusted.
 - 4. Previous payments.
 - 5. Sum remaining due.
 - 6. Receipts if requested by Architect.
- B. A final Change Order will reflect approved adjustments to the Contract Sum not previously made by Change Orders.

END OF SECTION

This page intentionally left blank

**Section 02 4100
Demolition**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 5713 - Temporary Erosion and Sediment Control.
- E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- G. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31 2323 - Fill.

PART 3 EXECUTION

3.01 SCOPE

- A. Remove the entire building designated on the Drawings..
- B. Remove paving and curbs as required to accomplish new work.
- C. Within area of new construction, remove foundation walls and footings in their entirety or as indicated on the Drawings.
- D. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade or as needed to implement new construction.
- E. Remove fences and gates.
- F. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
- B. Do not begin removal until receipt of notification to proceed from District.

3.03 EXISTING UTILITIES

- A. Protect existing utilities to remain from damage.
- B. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to District.

- C. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to District.
- D. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- E. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

This page intentionally left blank

**Section 03 0516
Underslab Vapor Barrier**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet vapor barrier under new concrete slabs on grade.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03 2000 - Concrete Reinforcing.
- C. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Underslab Vapor Barrier:
 - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
 - 2. Complying with ASTM E1745 Class A.
 - 3. Thickness: 15 mils.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, pipe boots, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches.
- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

**Section 03 1000
Concrete Forming and Accessories**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.
- C. Openings for other work.
- D. Form accessories.
- E. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions Division 01 Specification Sections, apply to this Section
- B. Section 03 2000 - Concrete Reinforcing.
- C. Section 03 3000 - Cast-in-Place Concrete.
- D. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- E. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures
- B. Product Data: Provide data on void form materials and installation requirements.
- C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties. Review and approval will not include form strength and adequacy.
- D. Keep an accurate record of the dates of removal of forms, form shores and reshores, and furnish copies to the SEOR.

1.05 QUALITY ASSURANCE

- A. Comply with the pertinent provisions of 01 4300 "Quality Requirements."
- B. Construct forms according to ACI 347, "Guide to Formwork for Concrete," and conforming to tolerances of ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials"

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Division 01 Section 01 67 00 "Product Requirements," delivering materials in a timely manner to ensure uninterrupted progress.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301.

2.02 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, B-B Medium or High Density Concrete Form Overlay, Class I, grade marked, not mill oiled.

- B. Lumber: DF species; WCLIB Construction grade or better, WWP A No. 1 grade or better; with grade stamp clearly visible.

2.03 FORMWORK ACCESSORIES

- A. Form ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, or equal, not leaving metal within 1-1/2" of concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
 - 1. Composition: Colorless, reactive, water-based or solvent-based compound.
 - 2. Do not use materials containing diesel oil or petroleum-based compounds.
 - 3. VOC Content: In compliance with applicable local, State, and federal regulations.
- C. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete. Sides of all footings and grade beams shall be formed, unless the member detail provides at least 3" clear cover to reinforcement and indicates the member is cast against earth. Remove formwork prior to backfilling operations.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.
- B. Rigidly construct forms to prevent mortar leakage, sagging, displacement or bulging between studs. Use clean, sound, approved form material, coated with specified materials only, not oil. Provide backing on all plywood joints.
- C. Coat forms with the specified resin coating, not form oil. Construct forms to exact shapes, sizes, lines and dimensions required to obtain level, plumb, and straight surfaces. Provide openings, offsets, keys, reglets, anchorages, recesses, moldings, chamfers, blocking, screeds, drips, bulkheads, and all other required features. Make forms easily removable without hammering or prying against concrete. Space forms apart with metal spreaders. Construct forms to accurate alignment, locations and grades, and provide against sagging, leakage of concrete mortar, or

displacement occurring during and after placing of concrete. Coordinate installation of inserts and anchors in forms according to shop drawings and requirements for work of other sections.

- D. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- E. Corners and angles: Provide 3/4" x 3/4" beveled chamfer strips for all exposed concrete corners and angles square unless indicated otherwise.
- F. Reglets and Rebates: Form required reglets and rebates to receive frames, flashing and other equipment. Obtain required dimensions, details, and precise positions for work to be installed under other sections and form concrete accordingly.
- G. Form Joints: Align joints and make watertight. Keep form joints to a minimum. Fill joints to produce smooth surfaces, intersections, and arises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.
- H. Recesses, Drips, and Profiles: Provide smooth milled wood or pre-formed rubber or plastic shapes of types shown and required.
- I. Cleanouts and Cleaning: Provide Temporary openings in all wall forms and other vertical forms for cleaning and inspection. Clean forms and surfaces to receive concrete prior to placing.
- J. Re-Use: Clean and Recondition form material before re-use.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. All necessary pipe sleeves, anchors, or other required inserts shall be accurately installed as part of the work of other sections, according to Specification Section 03 30 00, Section 1.3.B for submittal requirements related to this scope.
- B. Obtain approval before framing openings in structural members that are not indicated on drawings.
- C. Provide formed openings where required for items to be embedded in passing through concrete work.
- D. Locate and set in place items that will be cast directly into concrete.

- E. Conduits or pipes:
 - 1. Locate so as not to reduce strength of the concrete
 - 2. Do not place pipes, other than conduits, in a slab 4-1/2" thick or less in any case. Conduit buried in a concrete slab shall not have an outside dimension greater than 1/3 the slab thickness nor be placed below the bottom reinforcing or over the top reinforcement.
 - 3. Sleeves: Pipe sleeves may pass through the slab or walls if not exposed to rusting or other deterioration and are of uncoated or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.
- F. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- H. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- I. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.

3.07 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.
- B. Deflection: Limit Deflection of forming surfaces from concrete pressure to L/240.
- C. Finish Lines: Position formwork to maintain hardened concrete finish lines within following permissible deviations.
 - 1. Variation from Plumb:

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch
 - 2. Variation from Level or Grades Indicated

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch
 - 3. Cross-Sectional Dimensions
 - a. Minus 1/4 inch
 - b. Plus 1/2 inch

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.09 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and all superimposed loads as determined by testing field cured cylinders, but not sooner than specified in ACI 347 Section 3.6.2.3. Load supporting forms may be removed when concrete has attained 75 percent of required 28 day compressive strength, but no sooner than 3 days, provided construction is reshored. Vertical formwork for cast in place concrete walls may be removed no sooner than 1 day following concrete placement, provided that the contractor can demonstrate that no sloughing or sagging of concrete will occur.
 - 1. Reshore structural members as specified per ACI 347.
 - 2. Remove formwork progressively so unbalanced loads are not imposed on the structure.
 - 3. Avoid damage to concrete surfaces during removal.
 - 4. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

END OF SECTION

**Section 03 2000
Concrete Reinforcing**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing Steel for Concrete Foundations
- B. Reinforcing Steel for Concrete Slabs on Grade
- C. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions Division 01 Specification Sections, apply to this Section.
- B. Section 03 1000 - Concrete Forming and Accessories.
- C. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ACI 315 - Manual of Standard practice for Detailing Reinforced Concrete Structures; 2011.
- B. ACI SP-66 - ACI Detailing Manual; 2004.
- C. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2022a.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- G. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).
- H. CRSI (DA4) - Manual of Standard Practice; 2018, with Errata (2019).
- I. CRSI (P1) - Placing Reinforcing Bars; 2011.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for submittal procedures
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include the following:
 - 1. complete bar layout
 - 2. representative sections
 - 3. details for congested conditions
 - 4. proposed layout where vertical and horizontal bars intersect
 - 5. bar schedules
 - 6. typical bending diagrams and offsets
 - 7. shapes of bent bars
 - 8. spacing of bars
 - 9. splice lengths and locations
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

- A. Comply with the pertinent provisions of 01 43 00 "Quality Requirements."
- B. Perform work of this section in accordance with ACI SPEC-301.

1.06 DELIVERY STORAGE AND HANDLING

- A. Comply with pertinent provisions of Division 01 Section 01 6000 "Product Requirements," delivering materials in a timely manner to ensure uninterrupted progress.
- B. Bundle bars, tag with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken
- C. Avoid exposure to dirt, moisture or conditions harmful to reinforcement.

1.07 EXTRA MATERIAL

- A. Provide an allowance of an additional 10% of the total reinforcing steel tonnage in addition to the quantities shown on the drawings. This additional steel shall be installed in sizes and locations as directed by the structural engineer.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Deformed billet-steel bars.
 - 2. Unfinished.
 - 3. Only to be used for conditions where bars will not be welded.
- B. Reinforcing Steel: ASTM A706/A706M, Grade 60 (60,000 psi) deformed low-alloy steel bars.
 - 1. Unfinished.
 - 2. Used in all cases where welding of bars is required.
- C. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.
- D. Reinforcement Accessories:
 - 1. Tie Wire: ASTM A82, Annealed copper bearing steel, minimum 16 gage, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. Standard manufactured products shall conform to the Concrete Reinforcing Institute, "Manual of Standard Practice," latest edition.
 - 3. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Bending and Forming
 - 1. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials
 - 2. Do not heat reinforcement for bending
 - 3. Bend bars No. 6 size and larger in the shop only.
 - 4. Bars with unscheduled kinks or bends are subject to rejection.
 - 5. Use only tested and approved bar materials
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress. Review locations of splices with AOR.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Before placing bars, and again before concrete is placed, clean bars of loose rust and/or mill scale, dirt, oil, or any other coating that may be deleterious or could reduce bond with the concrete.

- B. Securing in place:
 - 1. Accurately place bars and wire tie in precise position where bars cross.
 - 2. Bend ends of wire ties away from the forms.
 - 3. Wire tie bars to the corners of ties and stirrups.
 - 4. Support bars according to the Concrete Reinforcing Steel Institute (CRSI) "Placing Reinforcing Bars," using approved accessories and chairs.
 - 5. Place precast concrete cubes with embedded wire ties to supporting reinforcing steel bars in concrete placed on grade and in footings.
 - 6. Take adequate precautions to ensure that reinforcing bar position and spacing is maintained during concrete placement.
- C. Do not displace or damage vapor barrier.
- D. Maintain concrete cover around reinforcing as follows:
 - 1. Refer to Drawings for cover requirements
- E. Splices:
 - 1. Do not splice reinforcing bars at the points of maximum stress except where indicated.
 - 2. Lap splices as shown or required to develop the full strength or stress of the bars.
 - 3. Stagger splices in horizontal wall bars at least 48" longitudinally in alternate bars and opposite faces.

3.02 FIELD QUALITY CONTROL

- A. Comply with all pertinent provisions of Division 01 Section 01 40 00 "Quality C".
- B. An independent testing agency, as specified in Section 01 4000, shall inspect installed reinforcement for conformance to contract documents before concrete placement.
- C. Supervision: Perform Work to this Section under supervision of a capable superintendent.

END OF SECTION

**Section 03 3000
Cast-in-Place Concrete**

PART 1 - GENERAL

1.01 Section Includes

- A. Section Includes cast-in-place concrete, concrete materials, mixture design, placement procedures and finishes for the following:
- B. Floors and slabs on grade.
- C. Joint devices associated with concrete work.
- D. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, and flagpole bases.
- E. Concrete curing.
- F. Concrete Foundations

1.02 Related Requirements

- A. Section 03 0516 - Underslab Vapor Barrier
- B. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.
- C. Section 03 2000 - Concrete Reinforcing.
- D. Section 03 3511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.
- E. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- F. Section 32 1313 - Concrete Paving: Sidewalks, curbs and gutters.

1.03 Reference Standards

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. {RSTEMP#10005595}
- C. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- D. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

- E. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
- F. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- H. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2012.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.
- K. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete; 2020.
- L. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete; 2020.
- M. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate; 2018.
- N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2023.
- O. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.
- P. ASTM C117 - Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing; 2017.
- Q. ASTM C131/C131M - Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine; 2020.
- R. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2019.
- S. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- T. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
- U. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2010.
- V. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- W. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2023.

- X. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
- Y. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2017.
- Z. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.
- AA. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.
- BB. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2014.
- CC. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.
- DD. ASTM D75 - Standard Practice for Sampling Aggregates; 2019.
- EE. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate; 2022.
- FF. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.
- GG. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.
- HH. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

1.04 Submittals

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Comply with the pertinent provisions of Section 01 6000 - Product Requirements. Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. Material Certificates: For Each of the following, signed by the manufacturer(s)
 - a. Cementitious materials
 - b. Admixtures
 - c. Curing compounds
 - d. Non-shrink grout
 - 2. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with the requirements:
 - a. Aggregates
- C. Mix Design: Submit proposed concrete mix design(s). For each concrete mixture:
 - 1. Indicate Intended Locations for use

2. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
 3. Indicate proposed mix design complies with requirements of ACI SPEC-301
 - a. Mixes shall be based on existing approved compressive strength test data for concrete mixes in accordance with ACI SPEC-301 and requirements below:
 - 1) Strength Requirements: Design mixes for structural concrete for minimum 28-day compressive strengths required by Drawings and Specifications. The trial batch strength for each mix shall exceed indicated or specified strength by 750 psi or a lesser amount based on the standard deviations of strength test records according to ACI SPEC-301.
 - 2) Normal Weight Concrete Mix Design: Design all mixes for workability and durability of concrete. Control the mixes in accordance with the CBC, ACI SPEC-301 Section 4.1.3. Make adjustments in cement content required for concrete strengths at Contractor's expense and do not exceed a cement to water ratio as indicated on concrete general notes of approved plans, absolute water-cement or cement plus fly ash or slag ratio by weight. Do not use calcium chloride or any admix containing such material. Admixtures containing a material releasing nitrates in solution are limited to 0.06 percent by weight for the chloride ion.
Design the mixes with 1" maximum size, except maximum 1-1/2" size for foundations as submitted by the contractor and approved by the Architect and Structural Engineer of Record.
 - 3) ACI SPEC-301 Section 4.1.2 with test records. Where a testing laboratory acceptable to the enforcement agency has records of compressive strength tests, a standard deviation shall be established. Test records from which a standard deviation is calculated shall:
 - (a) Represent materials, quality control procedures and conditions similar to those expected, and changes in materials and proportions within the test records shall not have been more restricted than those for proposed work.
 - (b) Represent concrete produced to meet a specified strength or strengths f'_{c} within 1,000 psi of that specified for proposed work.
 - (c) Must consist of at least 30 consecutive tests or two groups of consecutive tests totaling at least 30 tests as defined in ACI SPEC-301 Section 4.2.3.2.
 4. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Test Reports: Submit report for each test or series of tests specified.
- E. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- F. Delivery Tickets: With each transit truck provide delivery ticket, signed by an authorized representative from the batch plan, containing all information required by ASTM C94/C94M, as well as time batched, type of brand of cement, cement content, maximum size of aggregate and total water content.

1.05 Quality Assurance

- A. Comply with the pertinent provisions of 01 4000 - Quality Control

B. Qualifications

1. **Installer Qualifications:** An experienced installer who has completed concrete work similar in material, design, and extend to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance. Adequate numbers of trained and experienced personnell shall be used.
2. **Manufacturer Qualifications:** The production facility supplying hydraulic cement concrete shall have a current Certification of Ready Mixed Concrete Production Facilities from the National Ready Mixed Concrete Association, or equivalent.
3. **Concrete Testing and Inspection Services:** The owner shall engage a qualified Independent Testing Agency to perform evaluation test and special inspections per Structural Notes on Drawings and as required per the code. Personnel conducting test shallbe qualified as ACI Concrete Field Testing Technician, Grade 1 according to ACI CP-1 or an equivalent program.

C. Concrete placement sub-contractor to attend pre-installation meeting with concrete floor finishing sub-contractor prior to placement of concrete.

1. Meeting to include coordination of placement of recessed grilles and mats.

D. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

1. Maintain one copy of each document on site.

E. Follow recommendations of ACI PRC-305 when concreting during hot weather.**F. Follow recommendations of ACI PRC-306 when concreting during cold weather.****G. Source Quality Control:** Refer to the following paragraphs for specific procedures. Concrete materials which, by previous tests or actual service, have shown conformance may be used without testing when so approved by SEOR. Testing laboratory shall perform the following conformance testing

1. **Cementitious Material Test:** The concrete supplier shall furnish to the enforcement agency certification from the cement manufacturer that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ACI 318 Section 3.2.1 and the ASTM standards listed in the materials section of this Specification.
2. **Aggregates for Normal Weight Concrete:** Test the aggregate before and after concrete mix is designed and whenever character of aggregate varies or source of material is changed in accordance with ASTM C33/C33M and CBC. Include a sieve analysis. Obtain samples of aggregates at the dry batching or ready-mix concrete plant in accordance with ASTM D75 and perform tests for the properties listed in the following table:

Physical Properties		
Physical Properties, units	Test Method	Minimum Values
Sieve analysis	ASTM C136/C136M	Loss after 5 cycles not more than 8 percent of coarse aggregate, nor more than 10 percent of fine aggregate
Organic impurities	ASTM C40	Fine aggregate not darker than reference standard color

Physical Properties		
Physical Properties, units	Test Method	Minimum Values
Soundness	ASTM C88	
Abrasion	ASTM C131/C131M	Weight loss not more than 10.5 percent after 100 revolutions, 42 percent after 500 revolutions
Deleterious materials	ASTM C33/C33M A STM C330/C330M	
Materials finer than No. 200 sieve	ASTM C117	Not over 1 percent for gravel, 1.5 percent for crushed aggregate
Reactivity potential	ASTM C227, C289, C342	Ratio of silica released to reduction in alkalinity not to exceed 1.0.
Sand equivalent	ASTM D2419	California sand equivalent values operating range not below 71 percent

3. Concrete Batch Plant Inspections: Conform to CBC and ACI. Continuous batch plant inspection is required for structural concrete, performed by a specially qualified inspector.
- H. Compliance with Regulations: All materials shall comply with the current rules and regulations of the local air quality management district, with the rules regarding volatile organic compounds, and with FDA rules and regulations for dangerous substances in construction products.
- I. Allowable Tolerances: Construct concrete conforming to the tolerances specified in ACI 117, as applicable, unless exceeded by the requirements of regulatory agencies or otherwise indicated or specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 01 6000 - Product Requirements.
- B. Ready-mix concrete shall be mixed and delivered in accordance with ASTM C94/C94M . Each batch of concrete delivered to the Project site shall be accompanied by a time slip bearing departure time and signature of batch plant supervisor. Concrete shall be placed within 90 minutes after start of mixing. Concrete which has developed initial set shall not be used. Concrete which has partially hardened shall not be used. Deliver all materials in timely manner to ensure uninterrupted progress of the work.
- C. Deliver, store and handle all cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

1.07 JOB CONDITIONS

- A. Cold Weather Requirements:
1. Follow recommendations of ACI 306R A when concreting during cold weather.
 2. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. Surfaces, in which concrete is to come in contact with, shall be free from frost or ice. No frozen materials or materials containing ice shall be furnished.
 3. When placing concrete during freezing or near-freezing weather the mix shall have a temperature of at least 50 degrees F., but not more than 90 degrees F. when cement is added. Concrete shall be maintained at a temperature of at least 50 degrees F. for at least 72 hours after placing or until it has thoroughly hydrated. When necessary, concrete materials shall be heated before mixing. Special precautions shall be provided for protection of transit-mixed concrete.
- B. Hot Weather Requirements:
1. Follow recommendations of ACI 305R when concreting during hot weather.
 2. During hot weather, proper attention shall be provided for ingredients, production methods, handling, placing, protection and curing, to prevent excessive concrete temperatures or water evaporation which could impair required strength or durability.

PART 2 PRODUCTS

2.01 Formwork

- A. Comply with requirements of Section 03 1000.

2.02 Reinforcement Materials

- A. Comply with requirements of Section 03 2000.

2.03 Concrete Materials

- A. Cement: ASTM C595/C595M or ASTM C150/C150M, Type II - Moderate Portland type, low alkali. Provide Type V where concrete is in contact with soil corrosive to concrete.
- B. Fine and Coarse Aggregates: ASTM C 33, C330, and C 227, from approved pits, free from vegetable matter and of opaline, feldspar, or siliceous magnesium substances; all washed, clean, hard, fine-grained sound crushed rock or gravel; not over 5 percent by weight of flat, thin, elongated, friable, or laminated pieces (pieces having major dimension over 5 times average dimension) or more than 2 percent by weight of shale or cherty material. Any suitable individual grading of coarse aggregate may be furnished, provided Grading of Combined Aggregate indicated in following table is obtained.

GRADING OF COMBINED AGGREGATE			
Sieve Number or Size in Inches	1-1/2" Maximum (Percent)	1" Maximum (Percent)	3/4" Maximum (Percent)
Passing a 2"	-	-	-

GRADING OF COMBINED AGGREGATE			
Sieve Number or Size in Inches	1-1/2" Maximum (Percent)	1" Maximum (Percent)	3/4" Maximum (Percent)
Passing a 1-1/2"	95-100	-	-
Passing a 1"	70-90	90-100	-
Passing a 3/4"	50-80	70-95	90-100
Passing a 3/8"	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28
Passing a No. 50	2-12	5-15	5-15
Passing a No. 100	0-3	0-5	0-5

- C. Water: Water shall be potable and free from deleterious matter or shall otherwise satisfy the requirements of ASTM C1602/C1602M.
1. Acquire aggregates for entire project from same source.
- D. Pozzolan: ASTM C618, Class F or N Fly Ash (Class C Not permitted) subject to the conditions of the CBC, containing two percent or less carbon. Fly ash shall not be used in excess of 25 percent by weight of total cement quantity for structural concrete. Where fly ash replacement is 25% or higher, maximum water-cement ratio shall be 0.45. Fly ash need not be included in lightweight concrete mix designs.
- E. Ground Granulated Blast Furnace Slag: ASTM C989/C989M Slag shall not be used in excess of 25 percent by weight of total cement quantity for structural concrete.
1. Slag shall not be used in concrete to be polished.
- F. Water: Clean, potable and not detrimental to concrete, complying with ASTM C94/C94M and ASTM C1602/C1602M
- G. Concrete compressive strength shall be 3,000 psi minimum.

2.04 Admixtures

- A. Admixtures to be used in concrete shall be subject to prior approval by the Structural Engineer. Where more than one admixture is used, they shall be compatible. Use of admixtures shall be consistent throughout Work.
- B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- C. Air Entrainment Admixture: ASTM C260/C260M.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
1. Super-Plasticizers (High Range Water Reducers): ASTM C494/C494M, Type F. Capable of producing concrete which can be placed at 8 11 inch slump without segregation, capable of maintaining slump within 2" of that initially mixed for 2 hours, and of maintaining concrete temperature within 2 degrees F. from time of batching for 2 hours minimum.

- E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
 - 1. Only one brand. When used, are subject to approval of Structural Engineer of Record, and must reduce the mixing water at least 10 percent without entraining air in excess of 2 percent by volume. If the water reducing agent entrains more than 2 percent air, the water reduction shall be at least 12 percent, but in no case shall the water reducing agent entrain air in excess of 4 percent.
- F. Water Reducing Admixture: ASTM C494/C494M Type A.
 - 1. Only one brand. When used, are subject to approval of Structural Engineer of Record, and must reduce the mixing water at least 10 percent without entraining air in excess of 2 percent by volume. If the water reducing agent entrains more than 2 percent air, the water reduction shall be at least 12 percent, but in no case shall the water reducing agent entrain air in excess of 4 percent.

2.05 Accessory Materials

- A. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
 - 2. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.
 - 3. Non-gas-forming and free of oxidizing catalysts and inorganic accelerators, used as dry or damp pack, or mixed to a 20-second flow (CRC-C 611), without segregation or bleeding at any temperature between 45 degrees F and 100 degrees F.
 - 4. Low-Slump, Dry Pack Products:
 - a. Drypack: Field mixture of 1 part Portland cement to 2 parts fine aggregate mixed to a damp consistency such that a ball molded in the hands will stick together and hold its shape. In lieu of field mixing, Contractor may use factory mixed drypack material, such as Master Builders "Set Grout." f'c shall be equal to 5,000 psi.
- B. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, nonmetallic aggregate, and activator.

2.06 Bonding and Jointing Products

- A. Bonding Agent: "Weld-Crete," manufactured by Larsen Products Co., P.O. Box 2127, Rockville, MD 20852, Master Builders "Concresive," or equal.
- B. Construction Joint Materials: "Key-Kold" or "Kwik-Joint," of profiles indicated.
- C. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.
- D. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D 1751 and ASTM D1752.

2.07 FINISHING AND CURING MATERIALS

- A. Finishing Aids: Liquid applied at time of concrete finish to increase hydrolysis and improve workability and finish.
 - 1. Products:
 - a. Hydrocrete: HydroCrete or HydroGrind :www.hydro-crete.com/
 - b. Wagman Metal Products: G3 Finish Aid: www.wagmanmetal.com
 - c. Penetron; Peneseal FH-PS: www.penetron.com/#sle.
 - d. Solomon Colors; Solomon Colors Lythic Day1: www.solomoncolors.com/#sle.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- C. Moisture-Retaining Sheet: ASTM C171.
 - 1. Curing paper, regular.
 - 2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

2.08 CONCRETE MIXING

- A. Furnish ready-mixed concrete from an approved commercial off-site plant. Conform to ASTM C 94, except materials, testing, and mix designs as specified herein. Use transit mixer trucks equipped with automatic devices for recording number of revolutions of drum. Comply with CBC Section, 1905.
- B. Admixtures: All approved admixtures shall be introduced into the concrete at the batch plant. Field additions are not acceptable.
- C. Slump: Adjust quantity of water so concrete at point and time of placing does not exceed the slumps per plans when tested according to ASTM C143. Use the minimum water necessary for workability required by part of structure being cast.
- D. For compressive strength, density, fly ash or slag content, slump, and water-cement ratio, refer to the general notes in the plans.

2.09 Mixing

- A. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 Examination

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 GENERAL

- A. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the inspector at least 24 hours before placing concrete; do not place concrete until inspected by the inspector.
- B. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the SEOR.

3.03 Preparation

- A. Earth Subgrade: Dampen 24 hours before placing concrete, but do not muddy. Re-roll where necessary for smoothness and remove loose material.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Reglets and Rebates:
 - 1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.
 - 2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.
- D. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.
- E. Screeds Over Vapor Barrier: Use weighted pad or cradle type screeds and do not drive stakes through the vapor barrier. Check with an instrument level, transit, or laser.
- F. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- G. Remove all free water from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior surfaces of forms, exposed reinforcing, and from surfaces of mixing and conveying equipment.
- H. Wetting: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce absorption and to help maintain concrete workability.
- I. Gravel Fill: Recompact disturbed gravel and bring to correct elevation.
- J. All concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.

- K. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade per section 03 0516 - Underslab Vapor Barrier. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.04 Placing Concrete

- A. Sheet Vapor Retarders:
1. Place, protect, and repair sheet vapor retarder according to ASTM E1643, section 03 0516 - Underslab Vapor Barrier, and manufacturer's written instructions.
- B. Conveying and Placing:
1. Place concrete in accordance with ACI 304R.
 2. Do not place concrete until reinforcing steel and forms or decks have been approved by the Inspector and other authorities having jurisdiction. Concrete shall be placed only under direct observation of the inspector. Do not place concrete outside of regular working hours, unless the inspector has been notified at least 48 hours in advance.
 3. Comply with CBC Sections ACI 318 Section 26.5.2.
 4. Concrete shall be conveyed from mixer to location of final placement by methods, which will prevent separation or loss of materials. Place concrete in horizontal layers not more than 18" thick within 90 minutes after water is first added to the batch.
 5. In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 5-feet for concealed concrete or over 3-feet for exposed concrete.
 6. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.
 7. Concrete shall be thoroughly consolidated during placement, and shall be worked around reinforcement and embedded fixtures with mechanical vibrators.
 8. Where new concrete is placed against or on old or existing concrete, apply bonding agent to surface of old concrete prior to placement of new concrete.
- C. Compaction and Screeding:
1. Compacting: Compact each layer of the concrete as placed with mechanical vibrators or equivalent equipment. Transmit vibration directly to concrete and in no case through the forms unless approved. Accomplish thorough compaction. Supplement by rodding or spading by hand adjacent to forms. Compact concrete into corners and angles of forms and around reinforcement and embedded fixtures. Recompact deep sections with congestion due to reinforcing steel as required.
 2. Operation of Vibrators: Do not horizontally transport concrete in forms with vibrators nor allow vibrators to contact forms or reinforcing. Push vibrators vertically into the preceding layers that are still plastic and slowly withdraw, producing maximum obtainable density in concrete without creating voids or segregation. In no case disturb concrete that has partially set. Vibrate at intervals not exceeding two-thirds the effective visible vibration diameter of the submerged vibrator. Avoid excessive vibration that causes segregation.

3. Concrete must be vibrated at all headers, junction boxes and duct to insure that the concrete completely fills underneath the duct system. Care must be taken not to over vibrate. Shrinkage and temperature reinforcement above the duct systems shall be in accordance with ACI 318. Care shall be taken during concrete placement and, in particular, during concrete vibration, to prevent rising of top reinforcement within the slab. Contractors placing the concrete shall carefully hand finish a minimum of 24" [610mm] adjacent to junction box access openings so that the top of finished concrete and junction box access openings are flush with each other.
 4. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.
 5. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.
 6. Where concrete is to receive polished finish:
 - a. Screed with a vibratory straightedge and strike off at correct elevations.
 - b. Do not leave the vibratory screed at any one location while the vibrator is running; move it continuously across the slab.
 - c. Do not use a highway straightedge or bump cutter on the concrete surface during finishing operations.
- D. Floating and Troweling:
1. After concrete has been placed, struck off, consolidated, and restraightened, concrete shall not be worked further until ready for floating. Restraightening operation is best accomplished by use of 8 foot to 10 foot wide bull float. Power floating operations shall begin when the water sheen has disappeared, and when the mix has stiffened sufficiently to permit proper operation of power-driven float.
 2. Consolidate surface with power-driven floats. Hand floating with wood or cork faced floats shall be used in locations inaccessible to power driven machine. Surface shall be restraightened at this stage with ten foot highway straightedge applied at not less than two different angles.
 3. High spots shall be cut down and low spots filled during this procedure to produce planes checking true under straightedge in any direction. Uniformly slope surfaces to drains where occurs.
 4. Restraightening operation shall be followed by final float pass to uniform, smooth, granular texture.
 5. Where concrete is to receive polished finish:
 - a. Machine-trowel the slab edges and as close as possible to walls and columns. Minimize hand-finishing.
 - b. The troweled surface shall be free of trowel marks, burn marks, and mottling.
 - c. Do not trowel over adjacent hardened concrete surfaces. Inspect trowel machines prior to each pass and remove any accumulated mortar.
- E. Joints: Comply with CBC Section 1906.4. Locate joints in concrete only where shown or approved and obtain prior approval for points of stoppage of any pour. Clean and roughen surface of construction joints by removing entire surface and exposing 1/4" of clean coarse aggregate solidly embedded in mortar matrix by chipping, use of an approved retarder agent, or equal. Water and keep hardened concrete wet for not less than 24 hours before placing the next lift or abutting concrete. Cover the horizontal surfaces of existing or previously placed and

hardened concrete with a 2" thick layer of fresh concrete of required mix less 50 percent of coarse aggregate just before balance of concrete is placed.

- F. Vertical Elements: Stop placement of concrete in walls and columns 1 1/2" below bottom of beams or supported slabs. Stop placement at sills and heads of wall openings in the same manner. Allow concrete in vertical elements to be in place at least 2 hours and until vertical settlement has ceased before placing concrete for floor framing.
- G. Correction of Segregation: Before placing next layer of concrete, and at the top of each placement for vertical elements, remove all concrete containing excess water or fine aggregate, or showing deficiency of coarse aggregate, and fill the space with compacted concrete of correct proportions. Comply with ACI 318 Section 26.5.2.
- H. Filling, Leveling and Patching:
 - 1. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.
 - 2. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.
- I. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.05 EXPANSION AND CONSTRUCTION JOINTS

A. EXPANSION AND CONSTRUCTION JOINTS

- 1. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure. If construction joints are not shown in drawing, contractor to submit proposed locations to Structural Engineer of Record for approval. Construction joints shall be in accordance with the following:
 - a. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.
 - b. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.
 - c. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.
- 2. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab.
- 3. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated,

shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.06 Slab Jointing

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.07 Floor Flatness and Levelness Tolerances

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
 - 2. Concrete Floors to Ground and Polished:
 - a. Minimum F_F Floor Flatness and F_L Floor Levelness Values: F_F of 35; F_L of 35
 - b. Measure F_F Floor Flatness and F_L Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), report both composite overall values and local values for each measured section.
 - c. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F_F 23/ F_L 23.
 - 3. Under Seamless Resilient Flooring: 1/8 inch in 10 feet.
 - 4. Under Carpeting: 1/4 inch in 10 feet.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.08 Curing and Protection

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. All curing shall be per CBC Section 1905.11. Keep forms containing concrete in a wet condition until removed. Keep concrete continuously moist for not less than 7 days after placement. Keep concrete above 50°F and moist with a fine fog water spray until protected by curing media.
- D. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive

days after placing. Use the water curing method, curing sheet material, or a clear liquid membrane-forming curing compound except as otherwise specified.

- E. During times of dry or excessive winds, high ambient temperature, low humidity, or other ambient conditions causing rapid drying, use specified evaporation retardant and finishing aid material according to the manufacturers instructions and cure concrete with a fine fog spray of water, or equal, applied both during and after finishing and continued until final curing operations are started.
- F. Within 24 hours after finishing, exterior slabs and paving, and interior slabs to receive cement topping or mortar setting beds, shall be covered with sand to a depth of 2 inches and kept thoroughly wet for 7 days.
 - 1. Instead of sand covering, exterior walks and paving where no other surface treatment is specified, may be cured with clear liquid curing compound immediately installed in accordance with manufacturer's directions.
 - 2. At areas to receive polished concrete finish, silicate curing compounds are prohibited.
- G. Where fly ash or slag replacement is 20% or higher, floor slabs shall receive a 3 day moist cure and then 1 coat of approved curing compound. All other surfaces, with the exception of foundations, shall receive a coat of approved curing compound immediately after removal of formwork.

3.09 GROUTING AND DRYPACKING

- A. Install as indicated or required. Where grouting and drypacking is part of the work of other sections, it shall conform to the following requirements, as applicable.
- B. Drypacking: Mix materials thoroughly with minimum amount of water. Install drypack by forcing and rodding to fill voids and provide complete bearing under plates. Finish exposed surfaces smooth and cure with damp burlap or liquid curing compound.
- C. Non-Shrink Grouting:
 - 1. Mixing: Mix the approved non-shrink grout material with sufficient water per manufacturers recommendations.
 - 2. Application: Surfaces to receive the non-shrink grout shall be clean, and shall be moistened thoroughly immediately before placing the mortar. Before grouting, surfaces to be in contact shall be roughened and cleaned thoroughly, all loose particles shall be removed and the surface flushed thoroughly with neat cement grout immediately before the grouting mortar is placed. Place fluid grout from one side only and puddle, chain, or pump for complete filling of voids; do not remove the dams or forms until grout attains initial set. Finish exposed surfaces smooth, and cure as recommended by grout manufacturer.

3.10 Field Quality Control

- A. Comply with pertinent provisions of Section 01 4000 - Quality Control.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.

- C. Testing/Evaluation of Concrete: Conform to CBC and ACI. Testing Laboratory shall perform following tests. Samples for testing shall be obtained in accordance with AASTM C172/C172M, and shall be taken from as close to point of placement as possible.
1. Compressive Strength Tests: Cast one set of three or more cylinders from each days placing and each 50 cubic yards, or fraction thereof, or not less than once for each 2,000 square feet of surface area for slabs and walls, of each strength of structural concrete. Date cylinders, assign record number, and tag showing the location from which sample was taken. Also record slump test result of sample. Do not make more than two series of tests from any one location or batch of concrete.
 2. Test Cylinders: Samples will be made in accordance with ASTM C172/C172M . Cast cylinders according to ASTM C31/C31M ; 24 hours later, store cylinders under moist curing conditions at about 70 F. Test according to ASTM C39/C39M at 7 and 28 day ages. The remaining cylinder shall be kept in reserve in case tests are unsatisfactory.
- D. Core Tests: Comply with CBC and ACI. If tests show that compressive strength of any concrete falls below required minimum at 28 day age, additional curing and testing of concrete which unsatisfactory test reports represent may be directed. Testing Laboratory shall take and test drilled cores as directed in accordance with ASTM C42. Contractor shall refill core holes with drypack concrete of the same compressive strength required for cored concrete. If core tests results are unsatisfactory, Contractor shall furnish required labor, equipment, and weights, and the Testing Laboratory shall conduct load testing on involved parts of building or structure as directed. Contractor shall bear additional curing and test costs, including Testing Laboratory costs, for concrete not meeting required compressive strength at 28 day age even if testing demonstrates that concrete has eventually attained required minimum compressive strength, and all costs for required corrections or removals and replacements as directed and required for approved construction.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- G. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.11 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.12 Protection

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

This page intentionally left blank

**Section 03 3511
Concrete Floor Finishes**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface treatments for concrete floors and slabs.
- B. Liquid densifiers and hardeners.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Concrete Construction; 2020.
- B. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- C. ANSI B101.3 - Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials; 2012.
- D. ASME B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay); 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 FIELD CONDITIONS

- A. Comply with manufacturers written instructions for cure time, substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting topping performance.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

- A. Liquid Densifier and Hardener:
 - 1. Use at following locations: All locations shown on plans to have exposed existing and new concrete floors..

2.02 DENSIFIERS AND HARDENERS AND SEALERS

- A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
 - 1. Products:
 - a. Ashford Formula; Curecrete Distribution, Inc.: www.ashfordformula.com
 - b. W. R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

3.02 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1R.
- B. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal.
- C. Slip Resistance:
 - 1. Minimum wet dynamic coefficient of friction: 0.42 when measured per ANSI B101.3
 - 2. Minimum floor roughness of 0.41 micrometers (16 micro inches) when measured per ASME B46.1

3.03 PROTECTION

- A. Protect finished work until fully cured in accordance with manufacturers recommendations.

END OF SECTION

**Section 05 1200
Structural Steel Framing**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members, support members.
- B. Base plates.
- C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2025).
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).
- C. AISC 325 - Steel Construction Manual; 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- H. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2014.
- I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2021a.
- J. ASTM A673 - Standard Specification for Sampling Procedure for Impact Testing of Structural Steel; 2012

- K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- L. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.
- M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- O. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019, with Editorial Revision (2025).

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Shop Drawings:
 - 1. Submit Structural Steel Shop Drawings,:
 - a. Include complete details and schedules for fabrication and shop assembly of members,
 - b. Include details, schedules, procedures and diagrams showing the sequence of erection
 - c. Include a fully detailed, well controlled sequence and technique plan for shop and field welding that minimizes locked in stresses and distortion
 - d. Submit sequence and technique plan for review by the SEOR.
 - e. Include details of cuts, connections, camber, and holes in accordance with Figure 4.5 of AWS D1.1-10 or AISC 360 Section J1.8, weld position plan and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.
 - f. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed for Work specified in other sections.
 - g. Submit a list of steel items to be galvanized.
- C. Product Data:
 - 1. Submit copies of fabricator's specifications and installation instructions for the following products. Include laboratory test reports and other data required demonstrating compliance with these Specifications:
 - a. Structural Steel Including Chemical and Physical properties.
 - b. Welding electrodes
 - c. Welding Gas
 - d. Structural Steel Primer Paint
 - 2. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
- D. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- E. Mill Test Reports: Indicate structural tensile and yield strength, destructive test analysis and non-destructive test analysis.

- F. Welders Certificates: Field welders shall be Project certified in accordance with AWS D1. 1-10. Shop welders shall be Project certified for FCAWS in accordance with AWS D1. 1-10.
- G. Fabricator's Qualification Statement.
- H. Weld Procedures: Submit weld procedures for all connections. Weld procedures shall be prequalified or qualified as described in AWS D1.1, Section 4, Part B for self shielded FCAW, Weld procedures shall indicate joints details and tolerances, preheat and interpass temperature, post-heat treatment, single or multiple stringer passes, peening of stringer passes for groove welds except for the first and the last pass, electrode type and size, welding current, polarity and amperes and root treatment. The welding variables for each stringer pass shall be recorded and averaged, from these averages the weld heat input shall be calculated. Welding shall not proceed until WPS have been reviewed and approved by the Engineer of Record.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with the following Codes and Provisions as a Minimum Requirement:
 - 1. California Building Code, 2022 Edition, Chapter 22A, & Chapter 17A.
 - 2. AISC Standards:
 - a. AISC 303-16 - Code of Standard Practice for Steel Buildings and Bridges
 - b. AISC 360-16 - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings
 - 3. AWS Standards:
 - a. AWS D1.1 - Structural Welding Code - Steel
- B. Maintain one copy of each document on site.
- C. Fabricator Qualifications: A qualified steel fabricator that is accredited by one of the following:
 - 1. the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172).
 - 2. AISC Certification in accordance with the AISC Certification Program for Structural Steel Fabricators - Standard for Steel Building Structures (AISC 201-06)
- D. Erector: Company specializing in performing the work of this section
- E. Testing Laboratory shall perform conformance testing in accordance with the CBC:
 - 1. Identified Structural Steel: Tests are waived for steel identified by heat number, accompanied by mill analyses and mill test reports, and properly tagged with an Identification Certificate so as to be readily identified for conformance with applicable ASTM. Comply with the CBC.
 - 2. Unidentified Structural Steel: Steel not identified and certified as specified above shall be tested according to following requirements. Structural steel fabricator shall cut samples under direction of the Special Inspector and Testing Laboratory shall machine or otherwise prepare the specimens and perform testing of each 5 tons or fraction thereof for each size of unidentified steel except, in the case of random pieces or of steel having Fy greater than 36 Ksi, testing of each piece is required. Tests required are:
 - a. For pipe, one tension and elongation test and one flattening test for each size.

- b. For all other steel, one tension and elongation test and one bend test for each size.
 - c. Contractor shall reimburse to Owner all costs paid by Owner for testing unidentified steel.
- F. Testing & Inspection shall comply with the following:
- 1. All steel used for structural purposes shall be identified.. Manufacturer's mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.
 - 2. Inspection of shop fabrication shall be required for significant structural detailed connection and fabrication work as directed by the enforcement agency. This inspection shall be made by a qualified inspector approved by the enforcement agency. The inspector shall furnish the architect, structural engineer and the enforcement agency with a report that the materials and workmanship conform to the approved plans and specifications.
 - 3. Inspection of Welding. Inspection of all shop and field welding operations, including the installation of automatic end-welded stud shear connectors shall be made by a qualified welding inspector approved by the enforcement agency. Such inspector shall be a person trained and thoroughly experienced in inspecting welding operations. The inspector's ability to distinguish between sound and unsound welding shall be reliably established. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in the provisions of the ANSI/AWS QCI-1-96, Standard for AWS Certification of Welding Inspectors published by the American Welding Society. All welding inspectors shall be approved by the enforcement agency. The ability of each welder to produce sound welds of all types required by the work shall be established by welder qualification satisfactory to the enforcement agency.
 - 4. Welding inspection of structural welding shall conform to the requirements of AWS D1.1 Structural Welding Code – Steel, published by the American Welding Society, except as modified by this section.
 - 5. The welding inspector shall make a systematic record of all welds. This record shall include in addition to other required records:
 - a. Identification marks of welders.
 - b. List of defective welds.
 - c. Manner of correction of defects.
 - 6. The welding inspector shall check the material, equipment, details of construction and procedure, as well as the welds. The inspector shall also check the ability of the welder. The inspector shall verify that the installation procedure for automatic end-welded stud shear connectors is in accordance with the requirements of AWS D1.1, Structural Welding Code – Steel, published by the American Weld Society and the approved plans and specifications. The inspector shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding is proper and has been done in conformity with AWS D1.1, Structural Welding Code – Steel, published by the American Welding Society and the approved plans and specifications. The inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics or any other aid to visual inspection, which the inspector may deem necessary to be assured of the adequacy of the welding.

1.06 DELIVERY STORAGE AND HANDLING

- A. Store structural steel above grade on platforms, skids or other supports.
- B. Protect steel from corrosion.
- C. Storage and Care of Electrodes: Coatings of low-hydrogen type electrodes shall be thoroughly dry as used. Conform to AWS D1.1; use electrodes as taken from hermetically sealed packages within time limit specified therein after package is opened. Electrodes not used within allowable time period and electrodes that have been exposed more than one hour to air having a relative humidity of 75% or greater, or as required by the manufacturer, shall be dried according to AWS D1.1 before they are used, or shall be reconditioned according to electrode manufacturer's recommendations. Electrodes so dried or reconditioned not used within allowable time period after drying is completed shall be redried before use. Electrodes of any class that have been wet shall not be used under any conditions.
- D. Store other materials in a weathertight and dry place until installed into the Work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Plates: ASTM A36/A36M, for non-weathered steel
- B. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.
- C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B for non-weathered steel
- D. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.
- E. Unheaded Anchor Rods: ASTM F1554, Gr 36, 55 (with S1 weld supplement requirements) or 105 as indicated on the drawings, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436 Type 1 washers.
- F. Headed Anchor Rods: ASTM F1554 Grade 36, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
 - 1. Electrodes: AWS D5.1, E70XX Series Low Hydrogen Electrodes as required for intended use. All electrodes shall have a minimum Notch -Toughness of 20 FT-Lb at -20 degree F.
- H. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.

- B. Cleaning and Straightening: Thoroughly wire brush material, clean of loose mill scale and rust, and straighten by methods that will not injure the steel prior to fabrication. Remove twists or bends after punching or working component parts of a member before the parts are assembled. Produce finished members free from twists, bends, and open joints when erected.
- C. Contact: Pin components parts of built-up members and maintain in close contact using clamps or temporary bolting during welding operations. Accurately mill compression bearing surfaces of joints depending on contact bearings or saw cut square to axis, or as detailed. Cut other joints straight and true.
- D. Joining: Provide members of the sizes, weights, shapes, and arrangements indicated, closely fitted and finished true to line and in precise position as necessary to allow proper joining of parts in the field. Drifting to enlarge unfair holes is not allowed without prior approval.
- E. Drilling, Punching, and Reaming: Hole burning to make or enlarge previous holes is allowed only with prior approval. Prepare required holes in structural steel members for attachment or passage of Work of other trades. Precisely locate finished holes to ensure passage of all bolts through steel assemblies without drifting. Enlarge holes only by reaming. Poor matching of holes is cause for rejection.
- F. Holes For Anchor Bolts: Punch and drill or ream holes in base and bearing plates. Do not make or enlarge the holes by burning except for grouting holes in column bases without prior approval by the Architect.
- G. Gas Cutting: Use of a cutting torch is allowed where the metal being cut is not stressed during the operation, and provided stresses are not transmitted through a flame-cut surface. Make all gas cuts with a smooth regular contour. Deduct 1/8" from width of gas cut edges to determine effective width of members that are gas cut. Make radius of re-entrant gas cuts as large as possible, but 1" minimum.
- H. Galvanizing: After fabrication, items indicated or specified to be galvanized shall be galvanized in largest practical sizes. Fabrication includes operations of shearing, punching, bending, forming, assembling or welding. Galvanized items shall be free from projections, barbs, or icicles resulting from the galvanizing process.
- I. Welding:
 - 1. Type of steel furnished in welded structures shall provide chemical properties suitable for welding as determined by chemical analysis. Welds shall conform to the requirements of CBC Chapter 17A.
 - 2. Materials and workmanship shall conform to the requirements specified herein and to CBC requirements, modified as follows:
 - a. No welded splices shall be permitted except those indicated on Drawings unless specifically reviewed by the Engineer of Record and the DSA.
 - b. Drawings will designate joints in which it is important that welding sequence and technique be controlled to minimize shrinkage stresses and distortion.
 - 3. Welding shall be performed in accordance with requirements of the AWS Structural Welding Code.
- J. Shop Finish:

1. Notify the Inspector when Work is ready to receive shop prime coat. Work shall be inspected by the Inspector before installation of primer.
2. Structural steel and fittings, except galvanized items, which will be exposed when building is completed, shall receive a coat of primer.
3. The primer specified shall be spray applied, filling joints and corners and covering surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2.0 mils.

2.03 CONNECTIONS

- A. Make connections with bolts as noted on the Structural Drawings.

2.04 WELDING:

- A. Conform to CBC Section 1705A.2, AWS D1.1 as modified by referenced AISC Standards, and as indicated or noted on Drawings. Employ welding operators qualified in accordance with AWS D1.1, as applicable, who are thoroughly trained and experienced in arc welding and that produce uniformly reliable groove and fillet welds in flat, vertical, and overhead positions, and make neat and consistent welds. Weld all structural steel joints by shielded electric-arc method unless otherwise shown, specified, or approved. Conform welding in both shop and field, including the prequalification of welds and welder qualifications, to AWS D1.1.
- B. Preparation: Clean steel surfaces to be welded of all paint, grease, oil, mill scale, and foreign matter. Clean weld each time the electrode is changed. Chip full surface of hand guided and controlled flame cut edges before welding. Surfaces prepared with automatic or mechanically guided and controlled equipment need not be ground or chipped before welding.
- C. Weld Finishing: Grind exposed welds subject to contact to smooth surfaces free of holes, slag, or other defects, flush with the adjoining surfaces. No finish treatment is required for permanently concealed welds and other exposed welds.
- D. Procedures: During assembling and welding, hold components of a built-up member with adequate clamps or other means to keep parts straight and in close contact. Do no welding in wind until adequate protective screening is set up. Cut out defective welds or parts of welds with a chisel or air arc and replace.
- E. Weld Characteristics: Conform to AWS D1.1. Clean and wire brush all welds. Visual inspection of finished welds must show uniform section, smoothness of welded metal, feather edges without undercuts or overlays, freedom from porosity and inclusions, and good fusion and penetration into base metal at edges and ends of fillet welds.

2.05 FINISH

- A. Clean surfaces according to AISC Specifications. Apply one shop coat of specified metal primer to minimum 1.0 mil dry film thickness. Work primer into joints. Do not prime the following:

- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.06 SOURCE QUALITY CONTROL

- A. A qualified special inspector shall inspect high-strength bolted connections. The Owner will provide an independent testing laboratory to perform tests and prepare test reports in accordance with the CBC. The Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.
- B. An AWS CWI certified special inspector shall inspect welded connections. The Owner will provide an independent testing laboratory to perform tests and prepare test reports in accordance with the CBC. The Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.
- C. The independent testing laboratory shall conduct and interpret test and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
- D. Provide access to all places where structural steel Work is being fabricated or produced so required inspection and testing can be performed.
- E. The independent testing laboratory may inspect and/or test structural steel at plant before shipment; however, the Engineer of Record reserves the right at any time before Final Completion to deem materials not in compliance with the specified requirements as defective Work.
- F. Correct defects in structural Work when inspections and laboratory test reports indicate noncompliance with specified requirements. Perform additional tests as may be required to reconfirm noncompliance of original Work, and as may be required to show demonstrate compliance of corrected Work.
- G. Welding: Inspect and test during fabrication and erection of structural steel assemblies as follows:
 - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the Work. Record Work required and performed to correct deficiencies.
 - 2. Inspect welds. Welds shall be visually inspected before performing any non-destructive testing. Groove weld shall be inspected by ultrasonic or other approved non-destructive test methods.
 - 3. Base metal thicker than 1-1/2 inches, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected by shear wave methods for discontinuities directly behind such welds. Tests shall be performed at least 48 hours after completed joint has cooled down to ambient air temperature.
 - 4. Any material discontinuities shall be reviewed based on the defect rating in accordance with the criteria of AWS D1.1 table 6.3 by the SEOR.

5. Other method of non-destructive testing and inspection, for example, liquid dye penetrate testing, magnetic particle inspection or radiographic inspection may be performed on weld if required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.
- B. Verify governing dimensions and conditions of the Work before commencing erection Work. Verify elevations of concrete and masonry bearing surfaces, and locations of anchor rods, bearing plates and other Embedments.
- C. Provide temporary shoring and bracing, and other support during performance of the Work. Remove after steel is in place and connected, and after cast-in-place concrete has reached its design strength.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Employ qualified riggers and plan erection to require minimum cutting. Erect members plumb, true to line and level, and in precise positions. Provide temporary bracing and guying to resist loads and stresses to which the structure may be subjected, including those due to erection equipment and its operation.
- C. Anchor Bolts: Furnish and deliver anchor bolts with setting drawings and templates. Verify position of bolts prior to delivery of steel; report errors or deviation for correction.
- D. Clean surfaces of base plates and bearing plates.
 1. Install base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; cut off flush with edge of base or bearing plate before packing with grout.
- E. Maintain erection tolerances of structural steel within AISC Code of Standard Practice for Steel Buildings and Bridges.
- F. Align and adjust steel members. Adjust for variations in elevation or alignment. Level and plumb structural members.
- G. Do not permit thermal cutting during erection of structural steel.

- H. Connections: Hold steel in correct position during welding and bolting, and provide for dead loads, wind, and all erection stresses. Do no welding or final bolting until members have been aligned and plumbed.
 - 1. Field Welding: Conform to requirements for shop fabrication.
 - 2. Common Bolts: Tighten and upset bolt threads to preclude loosening, or use approved self-locking nuts.
- I. Where indicated for field connections, provide standard bolts complying with ASTM A325.
- J. Erect structural steel plumb and level and to proper tolerances as set forth in the AISC Manual. Provide temporary bracing, supports or connections required for complete safety of structure until final permanent connections are installed.
- K. Steel Columns: Set column bases in exact position for alignment, plumb and straight, supported on adjustable bolt supports or shims until grout has set. Set center of base true to column center within 1/16" and adjust column height exactly. Maintain bases at exact position and level during grouting. Fill grout space solid with non-shrink grout.
- L. Damaged Members: During erection, straighten or replace members which are bent, twisted, or damaged as directed. If heating is required, perform heating by methods that ensure a uniform temperature throughout the entire member. When directed, remove members damaged to an extent impairing appearance, strength, or serviceability and replace with new members at no extra cost to the Owner.
- M. Do not field cut or alter structural members without approval of Architect.
- N. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- O. Grout solidly between column or other bearing plates and concrete/masonry bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 FINISHING

- A. After erection, spots or surfaces where paint has been removed, damaged, or burned off and field rivets, bolts, and other field connections not concealed in the Work, shall be cleaned of dirt, oil, grease, and burned paint and furnished with a spot coat of the same primer installed during shop priming.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Install paint to exposed areas with the same material installed during shop painting. Install by brush or spray to provide a minimum dry film thickness of 1.5 mils.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

- B. Maximum Offset From true Alignment: 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency The owner will engage An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. All welders shall be qualified for each process and position per AWS D1.1 Chapter 4, Part C - Performance Qualifications.
- C. Testing Agency The owner will engage An independent testing agency will perform field quality control tests for all field welds and bolted connections as detailed in Section 1.5 above.
 - 1. Welded Connections: Visually inspect all field-welded connections. For all CJP welds test 100 percent of welds using the following:

3.06 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.07 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

This page intentionally left blank

**Section 05 5000
Metal Fabrications**

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Custom-fabricated connectors and plates
 - 2. Miscellaneous concealed framing and supports, including supports for countertops, downspouts, brackets, glass and plastic tank support framing, and other items not included under other Sections

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 06 1000 - Rough Carpentry
- C. Section 12 3600 - Countertops
- D. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
- H. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Plates: ASTM A283/A283M.
- C. Pipe: ASTM A53/A53M, Grade B Schedule 40, galvanized finish.
- D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- G. Fasteners: Provide type, grade, and class required for the particular use
 - 1. Provide zinc-coated fasteners with galvanizing complying with ASTM A153 for exterior use or where built into exterior walls.
 - 2. Fastenings exposed to public access shall be designed to alleviate vandalism and theft.
- H. Non-Metallic, Non-Shrink Grout: Premixed, conforming to ASTM C1107, with minimum compressive strength of 5000-psi at 28-days.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Metal Awnings:
 - 1. Manufacturer: Metallic Products, "Personnel Door Canopy"; (Basis of design), www.mpvent.com
 - 2. Size: 4'-6"W x 4'-0"D
 - 3. Construction:
 - a. 24 gauge flat soffit and integral gutter with rear mounted drains
 - b. 16 gauge galvanized internal frame
 - c. 5/8" diameter rod ends 4140 hot rolled annealed (HRA)
 - 4. Finish: Powder coated color to match McElroy Metals "Patina Green"
 - 5. Fasteners: Exposed fasteners shall be stainless steel or aluminum.
- B. Pipe downspout and support brackets.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
 - 1. Provide zinc coating for items exposed to exterior atmosphere, where shown on drawings, or specified to be galvanized using the hot-dip process after fabrication.
 - 2. Exterior standard bolts, cast-in-place anchor bolts and nuts shall be galvanized.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.
- E. After erection, prime welds, abrasions and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
- F. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply or brush or spray to provide minimum dry film thickness of 0.051 mm (2.0 mils).
- G. At all galvanized products, clean all damaged areas and re-coat using specified galvanizing coating per manufacturer's criteria.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

**Section 06 1000
Rough Carpentry**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural dimension lumber framing.
- B. Communications and electrical room mounting boards.
- C. Concealed wood blocking, nailers, and supports.
- D. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.
- B. Section 05 1200 - Structural Steel Framing: Prefabricated columns for support of wood framing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2015.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
- D. PS 1 - Structural Plywood; 2023.
- E. PS 2 - Performance Standard for Wood Structural Panels; 2019.
- F. PS 20 - American Softwood Lumber Standard; 2025.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.

- C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
 - 1. Species and Grades: As indicated on drawings for various locations.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: S4S, No. 2.

2.03 TIMBERS FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry (19 percent maximum).
- C. Beams and Posts 5 inches and over in thickness:
 - 1. Species: Douglas Fir-Larch.
 - 2. Grade: No. 1.

2.04 STRUCTURAL COMPOSITE LUMBER

- A. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
 - 1. Columns: Use laminated veneer lumber with manufacturer's published E (modulus of elasticity): 2,000,000 psi, minimum. Fb = 2,900 psi, minimum.
 - 2. Beams: Use laminated veneer lumber with manufacturer's published E (modulus of elasticity): 2,000,000 psi, minimum. Fb = 2,900 psi, minimum.

2.05 CONSTRUCTION PANELS

- A. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 32.
 - 3. Performance Category: 1/2 PERF CAT.
- B. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.
- C. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.06 ACCESSORIES

- A. Metal and Finish of Fasteners:
 - 1. Untreated Wood: Unfinished steel.
- B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
 - 1. Provide hangers manufactured by Simpson Strong-Tie.

PART 3 EXECUTION

3.01 PREPARATION

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
- E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.
- F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- G. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. Nail panels to framing; staples are not permitted.
- B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.07 SITE-APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.08 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.09 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.

3.10 CLEANING

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

This page intentionally left blank

**Section 06 4100
Architectural Wood Casework**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- ~~B. Plastic laminate countertops.~~
- C. Hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 07 9200 - Joint Sealants
- C. Division 22 Plumbing
- D. Division 23 Mechanical
- E. Division 26 Electrical
- F. Section 12 3600 Countertops

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- C. BHMA A156.9 - Cabinet Hardware; 2020.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- E. WI (CCP) - Certified Compliance Program (CCP); Current Edition.
- F. WI (MCP) - Monitored Compliance Program (MCP); Current Edition.
- G. ASTM D 1037 - 99 Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes. Shop Drawings shall have WI, Certified Compliance Label affixed to first page of drawing set.
- C. Product Data: Provide data for hardware accessories. Provide MSDS Sheets for all composite wood and agrifiber products, adhesives, and sealants used.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, and shelf standards, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with WI Manual of Millwork, Custom quality, unless other quality is indicated for specific items. The millwork supplier shall issue a W.I. Certificate Compliance Certificate indicating the grade of millwork products to be furnished for this job and certifying that they will fully meet all the requirements of the grade specified. Each unit of casework shall bear the W.I. Certificate Compliance label. Each plastic laminate countertop shall bear the W.I. Certified Compliance label. Upon the completion of the installation, a W.I. Certified Compliance shall be issued for the installation. The type of construction used must meet the seismic force requirements of Title 24.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Delivery shall only be made when the area of operation is enclosed, all wet work is dry, all overhead work is complete, and the area broom clean.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
- B. The HVAC system shall be on and functioning, and the architectural millwork shall be acclimated to these conditions for 72 hours prior to installation.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.

2.02 WOOD-BASED COMPONENTS

- A. Hardwood Faced Plywood: HPVA HP-1; graded in accordance with WI Manual of Millwork, core of lumber; exterior glue ; thickness 3/4";
 - 1. Exposed Open Shelving
 - 2. Semi Exposed Shelving
- B. Particleboard shall not be used
- C. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in WI Manual of Millwork; composed of wood fibers pressure bonded with moisture resistant formaldehyde free adhesive to suit application; sanded faces; thickness as indicated.
 - 1. Medite II, as manufactured by Roseburg, or approved equal
 - 2. Located at all casework construction, except as identified above.

2.06 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Formica Corporation: www.formica.com/#sle.
 - 2. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 3. Wilsonart LLC; (District Standard): www.wilsonart.com/#sle.
 - 4. Or approved equal, prior to bidding
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for all exposed applications as scheduled.
 - 1. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as indicated, finish as indicated.
- C. Melamine finish at all semi-exposed cabinet shelving, divisions and faces.
- D. Interior faces of cabinet doors to be faced with the same material as exposed surfaces.

2.09 ACCESSORIES

- A. Adhesive: Type recommended by WI to suit application.
- B. Plastic Edge Banding: Extruded ABS or PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 - 1. Color: As selected by Architect from manufacturer's full range to match cabinet face.
 - 2. Use at all exposed shelf edges.
 - 3. Use at door and drawer edges.
 - 4. All adhesives must meet or exceed the VOC limits of the South Coast Air Quality Management District Rule # 1168 (http://www.aqmd.gov/rules/reg/reg11_toqc.html)
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.10 HARDWARE

- A. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards and coordinated self rests, satin finish, for nominal 9/16 inch spacing adjustments.
 - 1. Standards, SP-1820, manufactured by Sugatsune or approved equal.
 - 2. Supports; SP-15, manufactured by Sugatsune or approved equal.
- B. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, ~ 4" inch centers
 - 1. Hafele #116.07.621 by Hafele
 - 2. EPCO
 - 3. Sugatsune
- C. Cabinet Catches and Latches:
 - 1. Product: MC0099 manufactured by Sugatsune
 - 2. Product: 323A92 manufactured by Ives
 - 3. Substitutions: See Section 01600 - Product Requirements.

- D. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Heavy Duty grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
 - 6. Manufacturers:
 - a. Accuride International, Inc; Heavy-Duty Drawer Slides: www accuride.com/#sle.
 - b. Hettich America, LP; _____: www.hettich.com/#sle.
 - c. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: www.knappeandvogt.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Hinges: Full-mortise 5-knuckle institutional type, steel with nickel-plated finish.
 - 1. Manufacturers:
 - a. Rockford Process Control, Inc: rockfordprocess.com - 450 series.
 - b. Or approved equal,
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- F. Silencers: Clear vinyl silencers to be installed at each cabinet door
- G. Wardrobe Hook
 - 1. # 582 Double, Aluminum, Manufactured by Ives or approved equal.

2.11 FABRICATION

- A. Cabinets shall be fabricated to Woodwork Institute standards
 - 1. Grade: Premium
- B. Exceptions to WI standards
 - 1. Wall Hung Cabinets : Depth 14 inches
 - 2. Shelves shall be designed as per schools and libraries, for a 50lb per square foot live load as per table 15-1.
 - 3. Exterior Edges: Include doors, drawer fronts, and front edge of vertical end panels and leg panels. Exterior edges are to be edged with heavy-duty 3mm PVC edgebanding, color to match door or drawer front.
 - 4. Locate grommets as directed by Owner. Assume one per workstation
- C. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- E. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

- F. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- G. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 CASEWORK INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- H. Secure upper cabinets, counter bases, full height cabinets, and counter partitions to floor and wall using appropriate angles and anchorages to obtain seismic restraint per Title 24 Section 2336

3.03 ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Defective work shall be repaired or replaced as directed by the Owner or his representative upon completion of installation.
- B. Shop finished surfaces shall be cleaned, touched-up as required and damaged or unrepairable areas shall be refinished or replaced as directed.
- C. Clean cabinetry free of debris. Installer shall be responsible for the immediate removal of all trash, crating, etc., associated with the cabinet installation.

3.05 SCHEDULES

- A. Finishes to be selected by architect from full line of colors and patterns. (Colors and Patterns are based on Formica Brand as a standard of quality unless otherwise noted.)

END OF SECTION

This page intentionally left blank

**Section 07 2100
Board and Batt Insulation**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thermal batt insulation in exterior wall, ceiling, and roof construction.
- B. Sound insulation at all interior demising walls not otherwise thermally insulated - size to fill void 5 1/2" min.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 07 5400 - Thermoplastic Membrane Roofing: Installation requirements for board insulation over low slope roof deck.

1.03 QUALITY ASSURANCE

- A. Installer - Work to be performed only by workers thoroughly skilled and specially trained in the techniques of insulation, and who are completely familiar with the published recommendations of the manufacturer of the material being used. Installer to take care that facing material of batt insulation is not torn or punctured.
- B. Materials of this section shall provide continuity of thermal barrier at building enclosure elements.

1.04 REFERENCE STANDARDS

- A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.07 PRODUCT HANDLING

- A. Protection
 - 1. Insulating materials to be stored at the job site in a safe, dry place with all labels intact and legible at time of installation.
 - 2. Comply with manufacturer's recommendations for handling, storage and protection during installation. Use all means to protect insulating materials before, during, and after installation. Do not allow products to become wet, damp, or punctured.
- B. Replacements - In the event of damage, including water intrusion, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation in Wood Framed Walls: Batt insulation with integral vapor retarder.
- B. Insulation in Wood Framed Ceiling Structure: Batt insulation with no vapor retarder.
- C. Insulation Over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
 - 1. Classifications:
 - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
 - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of core foam.

- 2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
- 3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 2 - 8.0 (1.41), minimum, at 75 degrees F.
2. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Water Vapor Permeance: 1.5 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
5. Board Size: 48 inch by 96 inch.
6. Board Thickness: 1.5 inch.
7. Board Edges: Square.
8. Products:
 - a. Atlas Roofing Corporation; AC Foam-II Polyiso Roof Insulation: www.atlasroofing.com
 - b. DuPont de Nemours, Inc: www.building.dupont.com
 - c. GAF; EnergyGuard Polyiso Insulation: www.gaf.com

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Batt Insulation: ASTM C 665; preformed glass fiber batt; friction fit, conforming to the following:
 1. Surface Burning Characteristics: Flame spread index of 25 or less; smoke developed index of 50 or less, when tested in accordance with ASTM E 84.
 2. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 3. Formaldehyde Content: Zero.
 4. Thermal Resistance: (Unless otherwise noted on plans with an increase value)
 - a. At Low Sloped Pitched Roof Area: R-38 unfaced batts plus R-11 unfaced batts at furring
 - b. At Flat Roof Areas: R-38 unfaced batts
 - c. At Exterior Walls: R-21 Kraft Face Batt.
 - d. Interior Wall Sound Insulation: fiberglass sound control batts 3-5/8" thick
 5. Facing: Asphalt treated Kraft paper, one side.
 6. Products:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Owens Corning Corp: www.owenscorning.com.
 7. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Provide all other materials and products necessary for the proper completion of the work.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

- D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.
- C. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where installation can properly begin.
- D. Verify that specified products may be installed in accordance with the original design and the manufacturer's recommendations.

3.02 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Board Installation Over Roof Deck, General:
 - 1. See applicable roofing specification section for specific board installation requirements.
 - 2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
 - 3. Do not apply more insulation than can be covered with roofing on the same day.

3.03 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Staple or nail facing flanges in place at maximum 6 inches on center.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.

- I. Tape seal tears or cuts in vapor retarder.
- J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

3.04 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

End of Section

This page intentionally left blank

**Section 07 6200
Sheet Metal Flashing and Trim**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM B32 - Standard Specification for Solder Metal; 2020.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- I. CDA A4050 - Copper in Architecture - Handbook; current edition.
- J. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.

- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sheet Metal Flashing and Trim:
 - 1. ATAS International, Inc. : atas.com
 - 2. Petersen Aluminum Corporation: www.pac-clad.com
 - 3. Berridge Manufacturing Co.: berridge.com
- B. Exterior Penetration Flashing Panel:
 - 1. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.
- B. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with silicone modified polyester coating.
 - 1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
 - 2. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 - 3. Color: As selected by Architect from manufacturer's full colors.
- C. Note: Flashing directly contacting the thermoplastic roof membrane is to be flashed with clad metal by the roofing manufacture.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- G. Fabricate flashings to allow toe to extend 2 inches over roofing . Return and brake edges.

2.04 GUTTER FABRICATION

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.im think
 - 3. Downspout Supports: Brackets.
- C. Downspout Boots: Plastic.
- D. Seal metal joints.

2.05 Flashing

- A. 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.

2.06 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- F. Screens: Tightly fitted screens to prevent the accumulation of leaves and debris in the gutter in accordance with CBC 705A.4

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.
- C. In the event of a discrepancy, immediately notify the Architect.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

- A. Gutters and exposed flashings to be prefinished aluminum.
- B. Galvanized sheet metal flashings are only to be used in locations not exposed to view, such as pan flashings at windows.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Secure gutters and downspouts in place with concealed fasteners.

END OF SECTION

Section 07 6500
Flexible Flashing

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible flashing system around window, door, and other openings and penetrations in walls.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.
- C. Section 07 9200 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

1.03 REFERENCE STANDARDS

- A. ASTM C510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants; 2016.
- B. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement; 2013.
- C. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2005 (Reapproved 2010).
- D. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- E. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- F. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.
- G. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2020).
- H. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2020.
- I. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

- J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- L. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section , for submittal procedures.
- B. Product Data: Provide data for flexible flashings and other accessories.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Flashing Manufacturer Qualifications: Company specializing in waterproofing flashings with ten years experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 30 year manufacturer warranty for flashing failing to resist penetration of water. Warranty to cover replacement of defective product as well as pay reasonable labor and material construction costs, including for work necessary to repair any damaged wall system components.

PART 2 PRODUCTS

2.01 FLASHING MATERIALS

- A. Self-Adhered Modified Bituminous Membrane:
 - 1. Thickness: 40 mil 0.040 inch
 - 2. Sheet Width: 4, 6, 9, 12, or 36 inch width as required for installation.
 - 3. Tensile Strength:
 - a. Membrane: 580 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
 - 4. Elongation at Break: 500 percent, minimum, measured according to ASTM D412.
 - 5. Water Vapor Permeance: 0.008 perm, maximum, measured in accordance with ASTM E96/E96M.
 - 6. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.

7. Water Absorption: 0.20 percent when tested in accordance with ASTM 1228
8. Sealants, Tapes and Accessories: As recommended by flashing manufacturer.
9. Manufacturers:
 - a. Top Industrial Inc.; Rain Buster 415 : www.topindustrial.com
- B. Mechanically Attached Elastomeric Flashing: Composite flashing formed of elastomeric inner core covered by a cross laminated polyethylenefilm on one face and a metallized polyester film on the other.
 1. Membrane Thickness: 25 mil
 2. Elongation, ASTM D412: >130%
 3. Tensile Strength, ASTM D412: 580 psi
 4. Sealants, Tapes and Accessories: As recommended by flashing manufacturer
 5. Manufacturers:
 - a. Top Industrial Inc.; Rain Buster 420 : www.topindustrial.com

2.02 ACCESSORIES

- A. Corner Flashings: premanufactured inside and outside once piece corner flashing utilized at corner transitions.
 1. Material: Low density polyethylene
 2. Manufacturers:
 - a. Top Industrial Inc.; Rain Buster 435 : www.topindustrial.com
- B. Sealant : Resilient polyurethane joint sealant compatible with substrates and flashing materials.
 1. Hardness (Shore A) per ASTM D2240 : 43
 2. Tensile Strength per ASTM D412: 225 psi
 3. Elongation per ASTM D412: 900%
 4. Adhesion in Peel per ASTM C794: Pass
 5. Stain & Color Change per ASTM C510: None
 6. Joint Movement Capability per ASTM C719: plus or minus 25%
 7. UV Resistance per ASTM C793: Excellent
 8. Color: White
 9. Manufacturers:
 - a. Top Industrial Inc.; Rain Buster 450 : www.topindustrial.com

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

- A. Clean and prepare surfaces to receive flexible flashing in accordance with manufacturer's instructions. Vacuum substrate clean.
- B. Do not apply flexible flashing to surfaces unacceptable to flashing manufacturer.
- C. Seal moving cracks with sealant, not rigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- D. Prepare building expansion joints as indicated on drawings.

3.03 INSTALLATION

- A. Install flexible flashing in accordance with manufacturer's instructions for level 3 installation.
- B. Self-Adhering Flashing: Apply flashing in accordance with manufacturer's instructions. Bond sheet to substrate except those areas directly over or within 3 inches of a control or expansion joint.
- C. Mechanically Fastened Flashing: Install mechanical fasteners in accordance with manufacturer's instructions.
- D. Overlap edges and ends and seal by method recommended by manufacturer, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- F. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams.
- G. Coordinate with weather barrier installation; see 07 2500 - Weather Barriers
- H. Install building expansion joints as indicated on drawings.
- I. Install flexible flashings. Seal items penetrating through membrane with flexible flashings. Seal watertight to membrane.

3.04 FIELD QUALITY CONTROL

- A. Installation of flexible flashing to be observed by manufacturer's representative. Manufacturer to provide memo stating observations.

END OF SECTION

Section 07 8400

Firestopping

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

- A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- E. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- F. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- G. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2023b.
- H. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- J. ITS (DIR) - Directory of Listed Products; Current Edition.
- K. FM (AG) - FM Approval Guide; Current Edition.
- L. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

- M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- N. UL (DIR) - Online Certifications Directory; Current Edition.
- O. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Installer's qualification statement.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Verification of minimum three years documented experience installing work of this type.
 - 2. Verification of at least five satisfactorily completed projects of comparable size and type.

1.05 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products; _____: www.3m.com/firestop/#sle.
 - 2. Hilti, Inc; _____: www.hilti.com/#sle.
 - 3. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.

2.02 MATERIALS

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- B. Acoustically Rated Firestopping: Provide system tested in accordance with ASTM E90 with STC rating of 50, minimum.

2.04 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

2.05 FIRESTOPPING SYSTEMS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by District's Independent Testing Agency.
- C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

- D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by District, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

**Section 07 9200
Joint Sealants**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 07 4646 - Fiber Cement Siding: Sealants installed as part of installation
- C. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- D. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.
- E. 32 1313 - Concrete Paving: Sealant at expansion joints

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 2. List of backing materials approved for use with the specific product.
 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 4. Substrates the product should not be used on.
- B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 2. Bostik Inc: www.bostik-us.com.
 3. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 4. Hilti, Inc: www.us.hilti.com/#sle.
 5. Pecora Corporation: www.pecora.com.
 6. Tremco Global Sealants: www.tremcosealants.com.
 7. Sherwin-Williams Company: www.sherwin-williams.com.
 8. Sika Corporation: www.usa-sika.com.
 9. W.R. Meadows, Inc: www.wrmeadows.com/sle.
- B. Self-Leveling Sealants:
1. Bostik Inc: www.bostik-us.com.
 2. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 3. Pecora Corporation: www.pecora.com.
 4. Tremco Global Sealants: www.tremcosealants.com.
 5. Sika Corporation: www.usa-sika.com.
 6. W.R. Meadows, Inc: www.wrmeadows.com/sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
 - a. Wall expansion and control joints.
 - b. Joints between different exposed materials.
 - c. Expansion joints in paving.
 - d. Other joints indicated below.
 2. Do Not Seal:
 - a. Intentional weep holes in masonry.
 - b. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.

- c. Joints where sealant installation is specified in other sections.
- B. Exterior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
 - 1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use nonsag polyurethane polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex Acrylic emulsion latex sealant.
 - 2. Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white white.
 - 3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- D. Interior Wet Areas: restrooms; fixtures in wet areas include plumbing fixtures, countertops, and cabinets.

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 6116.
- B. 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.
- C. Colors: As as selected by architect from manufacturer's full range

2.04 NONSAG JOINT SEALANTS

- A. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: Match adjacent finished surfaces.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: White.
- C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
 - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).

2.05 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 - 1. Movement Capability: Plus and minus 25 percent, minimum.

2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: Gray.
4. Products:
 - a. Pecora Corporation; Urexpam NR-200 and/or Dynatred: www.pecora.com.
 - b. Sherwin-Williams Company; Loxon SL1 Polyurethane Self-Leveling Sealant: www.sherwin-williams.com.
 - c. Sherwin-Williams Company; Loxon SL2 Polyurethane Self-Leveling Sealant: www.sherwin-williams.com.
 - d. Sika Corporation; Sikaflex-1c SL: usa.sika.com/#sle.
 - e. Sika Corporation; Sikaflex-2c SL: usa.sika.com/#sle.

2.06 ACCESSORIES

- A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 POST-OCCUPANCY

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION

This page intentionally left blank

**Section 08 1113
Hollow Metal Doors and Frames**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Thermally insulated hollow metal doors with frames.
- D. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 1416 - Wood Doors
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- D. Section 09 9113 - Exterior Painting: Field painting.
- E. Section 09 9123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. HMMA: Hollow Metal Manufacturers Association.
- C. NAAMM: National Association of Architectural Metal Manufacturers.
- D. NFPA: National Fire Protection Association.
- E. SDI: Steel Door Institute.
- F. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- I. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.
- J. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2019.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- L. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- P. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Steelcraft, an Allegion brand; L Series Doors, F Series Frames: www.allegion.com
 - 3. Curries Company; an Assa Abloy Group company.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.

6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on NAAMM HMMA Custom Guidelines: Provide at least A25/ZF75 (galvannealed) for interior applications, and at least A60/ZF180 (galvannealed) or G60/Z180 (galvanized) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.
- C. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 2. Core Material: Vertical steel stiffeners with fiberglass batts.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 3. Door Thermal Resistance: R-Value of 2.67 per ASTM C1363
 4. Door Thickness: 1-3/4 inches, nominal.
 5. Top Closures for Outswinging Doors: Flush with top of faces and edges.

- 6. Weatherstripping: Refer to Section 08 7100.
- 7. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
 - 3. Weatherstripping: Separate, see Section 08 7100.
 - 4. Exterior doors shall have 1 inch deep exterior stucco flange with a minimum of 1 inch return flush with exterior wall.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- F. Transom Bars: Fixed, of profile same as jamb and head.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
 - 3. Glazing: 1 inch thick, insulated, tempered glass, in compliance with requirements of authorities having jurisdiction. Refer to Section 08 8000
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 7100.

3.03 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

**SECTION 08 71 00
DOOR HARDWARE**

PART 1 -GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Door hardware.
 - 2. Storefront and entrance door hardware.
 - 3. Gate Hardware.
 - 4. Third-party inspection report for fire-rated door assemblies.
 - 5. Cylinders for doors fabricated with locking hardware.
- B. Related Divisions:
 - 1. Division 06 – door hardware installation
 - 2. Division 07 – Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
 - 3. Division 08 – metal doors and frames, wood doors, storefront and glazed curtainwall systems.
- C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
 - 1. Windows.
 - 2. Cabinets, including open wall shelving and locks.
 - 3. Signs.
 - 4. Toilet accessories, including grab bars.
 - 5. Installation.
 - 6. Rough hardware.
 - 7. Conduit, junction boxes & wiring.
 - 8. Access doors and panels.

1.2 REFERENCES:

- A. Use date of standard in effect as of Bid date.
 - 1. American National Standards Institute
 - a) ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties.
 - 2. BHMA – Builders Hardware Manufacturers Association
 - 3. 2022 California Building Code.
 - a) Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
 - 4. DHI – Door and Hardware Institute.

5. NFPA – National Fire Protection Association
 - a) NFPA 80 2022 Edition – Standard for Fire Doors and Other Opening Protectives.
 - b) NFPA 105 – Smoke and Draft Control Door Assemblies
 - c) NFPA 252 – Fire Tests of Door Assemblies
 6. UL – Underwriters Laboratories
 - a) UL10C – Positive Pressure Fire Tests of Door Assemblies.
 - b) UL 305 – Panic Hardware
 7. WHI – Warnock Hersey Incorporated State of California Building Code
 8. Local applicable codes
 9. SDI – Steel Door Institute
 10. WI – Woodwork Institute
 11. AWI – Architectural Woodwork Institute
 12. NAAMM – National Association of Architectural Metal Manufacturers
- B. Abbreviations
1. Manufacturers: see table at 2.1.A of this section.
 2. Finishes: see 2.7 of this section.

1.3 SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS: Submit electronic copy of schedule. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
1. Type, style, function, size, quantity, and finish of hardware items.
 2. Use BHMA Finish codes per ANSI A156.18.
 3. Name, part number and manufacturer of each item.
 4. Fastenings and other pertinent information.
 5. Location of hardware set coordinated with floor plans and door schedule.
 6. Explanation of abbreviations, symbols, and codes contained in schedule.
 7. Mounting locations for hardware.
 8. Door and frame sizes, materials, and degrees of swing.
 9. List of manufacturers used and their nearest representative with address and phone number.
 10. Catalog cuts.
- B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.
- C. Deviations: Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.
- D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
- E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.

- F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
- G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.4 QUALITY ASSURANCE:

- A. Qualifications:
 - 1. Hardware supplier: direct factory contract supplier who employs a hardware consultant, available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
 - a) Responsible for detailing, scheduling, and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
- B. Hardware: Free of defects, blemishes, and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from one manufacturer.
- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
- E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
 - 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.6 PROJECT CONDITIONS AND COORDINATION:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.

- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
 - 1. Location of embedded and attached items to concrete.
 - 2. Location of wall-mounted hardware, including wall stops. Note: Careful coordination required for reinforcement/blocking for wall stop support. If random inspection yields an unsupported wall stop, all locations will be rebuilt at no expense to the Owner or Architect.
 - 3. Location of finish floor materials and floor-mounted hardware.
 - 4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
 - 5. Coordinate: flush top rails of doors at out swinging exteriors, and throughout where adhesive-mounted seals occur.
 - 6. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

1.7 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.
- B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:
- C. Minimum warranties:

1.	Mortise Locksets:	Ten years mechanical
2.	Extra Heavy-Duty Cylindrical Lock:	Ten years mechanical
3.	Exit Devices:	Ten years mechanical
4.	Closers:	Thirty years mechanical
5.	Hinges:	One year
6.	Continuous Hinges	Lifetime, One year for electrified
7.	Other Hardware	Two years

1.8 COMMISSIONING:

- A. Conduct these tests prior to request for certificate of substantial completion:
 - 1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.
 - 2. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

1.9 REGULATORY REQUIREMENTS:

- A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2022 California Building Code, Section 11B-404.2.7.
 - 1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
- B. Handles, pull, latches, locks, other operable parts:
 - 1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2022 California Building Code Section 11B-309.4.
 - 2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 California Building Code Section 11B-309.4.
- C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for required fire doors to achieve positive latching, but not to exceed 15-pounds.
 - 1. Exception: When, at a single location, one of every eight exterior door leafs, or fraction of eight, is a powered door, other exterior doors at the same location, servicing the same interior space, may have a maximum opening force of 8.5 pounds (37.8N). The powered leaf(s) shall be located closest to the accessible route.
- D. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2022 California Building Code Section 11B-404.2.8.
 - 1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully closed.
- E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2022 California Building Code Section 11B-404.2.10.

1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges. Cavities created by kickplates to be capped per 2022 California Building Code Section 11B-404.2.10.
 2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
- F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2022 California Building Code Section 11B-404.2.3.
1. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
 2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 California Building Code 11B-307.4.
- G. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2022 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2022 California Building Code Section 11B-303.2 & ~.3.
- H. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
- I. Pairs of doors with independently activated hardware both leaves: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2022 California Building Code Section 11B-703.4.2.

PART 2 PRODUCTS**2.1 MANUFACTURERS:**

- A. Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:	ACCEPTABLE ALTERNATE:
Hinges	(IVE) Ives	Bommer
Continuous Hinges	(IVE) Ives	Select
Key System	(SCH) Schlage	Owner standard
Mechanical Locks	(SCH) Schlage	Owner standard
Exit Devices	(VON) Von Duprin	Owner standard
Closers	(LCN) LCN	Owner standard
Auto Flush Bolts	(IVE) Ives	DCI
Coordinators	(IVE) Ives	DCI
Push & Pull Plates	(IVE) Ives	Rockwood, Trimco
Kickplates	(IVE) Ives	Rockwood, Trimco
Stops & Holders	(IVE) Ives	Rockwood, Trimco
Overhead Stops	(GLY) Glynn-Johnson	ABH
Thresholds	(ZER) Zero	NGP, Pemko
Seals & Bottoms	(ZER) Zero	NGP, Pemko

2.2 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
- C. Conventional Hinges: Steel or stainless-steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Out-swinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
 2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
- D. Continuous Hinges:
1. Geared-type aluminum.
 - a) Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.
 - b) If units are used at storefront openings, color-coordinate hinge finish with storefront color. Custom anodizing and custom powder coat finishes subject to Architect approval.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

- A. Mortise Locksets and Latchsets: as scheduled.
1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
 2. Universal lock case – 10 functions in one case.
 3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
 4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.
 5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
 - a) Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
 - b) Inside lever applied by screwless shank mounting – no exposed trim mount screws.
 - c) Levers rotate up or down for ease of use.
 - d) Vandalgard locks: locked lever freely rotates down while remaining securely locked. This feature prevents damage to internal lock components when subjected to excessive force.
 6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
 7. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
 8. Strikes: 16 gage curved steel, bronze or brass with 1-inch-deep box construction, lips of sufficient length to clear trim and protect clothing.
 9. Scheduled Lock Series and Design: Schlage L series, 06A design.
 10. Certifications:
 - a) ANSI A156.13, 1994, Grade 1 Operational.
 - b) ANSI/ASTM F476-84 Grade 31 UL Listed.
 11. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2022 11B-404.2.7 and 11B-309.4.
 12. Accepted substitutions: None.
- B. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.

1. Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
2. Locking Spindle: stainless steel, integrated spring and spindle design.
3. Latch Retractors: forged steel. Balance of inner parts: corrosion-resistant plated steel, or stainless steel.
4. Latchbolt: solid steel.
5. Backset: 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.
6. Lever Trim: accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to door face.
7. Strikes: 16 gage curved steel, bronze or brass with 1.00-inch-deep box construction, lips of sufficient length to clear trim and protect clothing.
8. Lock Series and Design: Schlage ND series, "Rhodes" design.
9. Certifications:
 - a) ANSI A156.2, Series 4000, Grade 1.
 - b) UL listed for A label and lesser class single doors up to 4 feet x 8 feet.
10. Accessibility: Require not more than 5 lb. to retract the latchbolt or deadbolt, or both, per CBC 2022 11B-404.2.7 and 11B-309.4
11. Accepted substitutions: None.

2.4 EXIT DEVICES / PANIC HARDWARE

A. General features:

1. Independent lab-tested 1,000,000 cycles.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75-inch projection.
4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Accessibility: Require not more than 5 lb. to retract the latchbolt, per CBC 2022 11B-404.2.7 and 11B-309.4.
 - a) Mechanical method: Von Duprin "AX - feature", where touchpad directly retracts the latchbolt with 5 lb. or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb. requirement.

B. Specific features:

1. Non-Fire Rated Devices: cylinder dogging with security indicator.
2. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130-inch thickness, compression spring drive, match lockset lever design.
3. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.

4. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
5. Accepted substitutions: None.

2.5 CLOSERS

A. Surface Closers: 4040XP

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast-iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
 - a) Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
9. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
10. Exterior doors: seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
11. Non-flaming fluid will not fuel door or floor covering fires.
12. Pressure Relief Valves (PRV) not permitted.
13. Accepted substitutions: None.

2.6 OTHER HARDWARE

- A. Automatic Flush Bolts: Low operating force design.
- B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- D. Door Stops: Provide stops to protect walls, casework, or other hardware.

1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
 2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg dead stop. Note degree of opening in submittal.
- E. Seals: Four-fingered type at head & jambs. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.
1. Proposed substitutions: submit for approval.
 2. Three-fingered type at hinge jambs of doors fitted with continuous hinges where jamb leaf of hinge is fastened to the frame reveal.
- F. Thresholds: As scheduled and per details. Comply with CBC 2022 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
1. Saddle thresholds: 0.125 inches minimum thickness.
 2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25-inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
 3. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
 4. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
 5. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
 6. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full thread. Sleeve nuts: full length to prevent door compression.
- G. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.
1. Exception: surface-mounted overhead stops, holders, and friction stays.

2.7 FINISH:

- A. Generally: BHMA 626 Satin Chromium.
1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

2.8 KEYING REQUIREMENTS:

- A. Key System: (Verify with Owner) Schlage Everest T utility-patented keyway, interchangeable core. Utility patent protection to extend at least until 2029. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner and Allegion representatives to determine system keyway(s), keybow styles, structure and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Contractor will install permanent cylinders/cores.
- B. Keys
 - 1. Existing factory registered master key system.
 - 2. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.
 - 3. Furnish 10 construction keys.
 - 4. Furnish 2 construction control keys.
 - 5. Furnish 2 Emergency keys per each L9485 Faculty Restroom Lock
- C. Key Cylinders: furnish utility patented, 6-pin solid brass construction.
- D. Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
- E. Permanent keys: use secured shipment direct from point of origination to Owner.
 - 1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
 - 2. For estimate: VKC stamping plus "DO NOT DUPLICATE".
 - 3. Bitting List: use secured shipment direct from point of origination to Owner upon completion.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

- A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
 - 1. Notify Architect of code conflicts before ordering material.

1. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1008.1.9.2 and 11B-404.2.7.
 2. Locate panic hardware between 36 inches to 44 inches above the finished floor.
 3. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

3.3 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
 2. Use manufacturers' fasteners furnished with hardware items or submit Request for Substitution with Architect.
 3. Replace fasteners damaged by power-driven tools.
- B. Locate floor stops no more than 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- C. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- E. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants".
- F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- G. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- H. Drill pilot holes for fasteners in wood doors and/or frames.

3.4. ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
 2. Adjust doors to fully latch with no more than 1 pound of pressure.

- a) Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
- 3. Adjust door closers per 1.9 this section.
- B. Inspection of fire door assemblies and means-of-egress panic-hardware doors: Per 2022 NFPA-80 5.2.1: hire an independent third-party inspection service to prepare a report listing these doors and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware.
- C. Fire-rated doors:
 - 1. Wood doors: adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
 - 2. Steel doors: adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
 - 3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.
- D. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
 - 1. Has re-adjusted hardware.
 - 2. Has evaluated maintenance procedures and recommend changes or additions and instructed Owner's personnel.
 - 3. Has identified items that have deteriorated or failed.
 - 4. Has submitted written report identifying problems.

3.5 DEMONSTRATION:

- A. Demonstrate mechanical hardware, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
- B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.7 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

Opt. #: OPT0406632-V1

HARDWARE GROUP NO. 01

Provide each PR door(s) with the following:

8	EA	HINGE	3CB1HW SH 4.5 X 4.5 NRP		630	IVE
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-EO		626	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-L-NL-06		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX X K510-730 36-083		626	SCH
2	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 SPEC		689	LCN
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595 SPEC		689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT (AS REQUIRED)		689	LCN
1	EA	FLOOR STOP	FS441		626	IVE
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	EA	MEETING STILE	155AA		AA	ZER
1	EA	MEETING STILE	55AA		AA	ZER
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	547A-223 OR AS DETAILED		A	ZER

Project Name: Oxnard College OE Building Alterations**Job Number: 3244-01-ED24****Section 08 7100****HARDWARE GROUP NO. 03**

Provide each SGL door(s) with the following:

4	EA	HINGE	3CB1HW SH 4.5 X 4.5 NRP		630	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	LV9071T 06A IS-LOC		626	SCH
2	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	LOCK GUARD	LG12		600	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595 SPEC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	547A-223 OR AS DETAILED		A	ZER

HARDWARE GROUP NO. 04

Provide each PR door(s) with the following:

6	EA	HINGE	3CB1 4.5 X 4.5		630	IVE
1	EA	CONST LATCHING BOLT	FB51P/FB61P AS REQ'D		630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQ'D		626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB1/MB2 AS REQ'D		689	IVE
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS436/FS438 AS REQ'D		626	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	MEETING STILE	383AA		AA	ZER

HARDWARE GROUP NO. 05

Provide each PR door(s) with the following:

6	EA	HINGE	3CB1 4.5 X 4.5		630	IVE
1	EA	CONST LATCHING BOLT	FB51P/FB61P AS REQ'D		630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQ'D		626	IVE
1	EA	CLASSROOM SECURITY	ND78TD RHO		626	SCH
2	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB1/MB2 AS REQ'D		689	IVE
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	FLOOR STOP	FS436/FS438 AS REQ'D		626	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	MEETING STILE	383AA		AA	ZER

Project Name: Oxnard College OE Building Alterations**Job Number: 3244-01-ED24****Section 08 7100****HARDWARE GROUP NO. 06**

Provide each SGL door(s) with the following:

3	EA	HINGE	3CB1HW 4.5 X 4.5		630	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	FLOOR STOP	FS436/FS438 AS REQ'D		626	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. 07

Provide each SGL door(s) with the following:

3	EA	HINGE	3CB1HW 4.5 X 4.5		630	IVE
1	EA	CLASSROOM SECURITY	ND78TD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. 08

Provide each SGL door(s) with the following:

3	EA	HINGE	3CB1HW 4.5 X 4.5		630	IVE
1	EA	CLASSROOM SECURITY	ND78TD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. 10

Provide each SGL door(s) with the following:

3	EA	HINGE	3CB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	FLOOR STOP	FS436/FS438 AS REQ'D		626	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. 11

Provide each SGL door(s) with the following:

4	EA	HINGE	3CB1HW 4.5 X 4.5		630	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	LV9071T 06A IS-LOC		626	SCH
2	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	547A-223 OR AS DETAILED		A	ZER

HARDWARE GROUP NO. 12

Provide each SGL door(s) with the following:

3	EA	HINGE	3CB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

HARDWARE GROUP NO. 13

Provide each SGL door(s) with the following:

3	EA	HINGE	3CB1HW 4.5 X 4.5		630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	FSIC CORE	23-030 EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

Section 08 8000

Glazing

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- B. Section 08 1213 - Hollow Metal Frames: Glazed borrowed lites.
- C. Section 08 1400 - Wood Doors: Glazed lites in doors.
- D. Section 08 5113 - Aluminum Windows: Glazing provided by window manufacturer.
- E. Section 10 2813 - Toilet Accessories: Mirrors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- F. GANA (GM) - GANA Glazing Manual; 2022.
- G. GANA (SM) - GANA Sealant Manual; 2008.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.

- B. Product Data on Insulating Glass Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 12 by 12 inch in size of glass units.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM) for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. 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.
- C. 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. Guardian Industries Corp: www.sunguardglass.com.
 - 2. Pilkington North America Inc: www.pilkington.com/na.
 - 3. PPG Industries, Inc; Basis of Design: www.ppgideascales.com.
 - 4. Oldcastle Building Envelope: www.obe.com

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 - 2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 - 3. Patterned Glass Type: ASTM C1036, Type II - Patterned Flat Glass, Quality - Q5, Form 3 - Patterned glass, with color and performance characteristics as indicated.

2.03 GLAZING UNITS

- A. Type G-2 - Monolithic Interior Vision Glazing:
 - 1. Applications: Interior glazing unless otherwise indicated.
 - 2. Glass Type: Annealed float glass.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch, nominal.

2.04 ACCESSORIES

- 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: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- D. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- E. 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.

- F. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

This page intentionally left blank

**Section 09 2116
Gypsum Board Assemblies**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cementitious backing board.
- B. Gypsum wallboard.
- C. Joint treatment and accessories.
- D. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry.
- B. Section 07 2100 - Board and Batt Insulation
- C. Section 07 9200 - Joint Sealants
- D. Section 09 3000 - Tiling

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- D. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.
- E. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).
- F. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- H. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 3. National Gypsum Company: www.nationalgypsum.com.
 - 4. USG Corporation: www.usg.com.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required within 10 feet of a sink and other plumbing fixtures and within at least 2 feet around and perpendicular to exterior door openings.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
- C. Backing Board For Wet Areas:
 - 1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 - 1. Application: Walls and ceilings at toilet rooms and vestibule where there is no plumbing fixture mounted..
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Regular Board Thickness: 5/8 inch.
 - 4. Edges: Tapered.
 - 5. Products:
 - a. American Gypsum Company; M-Bloc: www.americangypsum.com/#sle.

- b. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
- c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board:
www.gpgypsum.com/#sle.
- d. Georgia-Pacific Gypsum; DensShield Tile Backer.
- e. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place continuous bead at perimeter of each layer of gypsum board.
- C. Caulking for Sound Control: Insulate construction with caulk as indicated on Drawings. In addition, caulk penetrations at conduit, pipes, ducts, registers, etc., so that such openings are sealed tight against passage of airborne sound.
 - 1. Holes smaller than 1" but too large to caulk shall be packed with glass fiber, sealed over with 1/16 inch thick sheet lead and then caulked airtight.
 - 2. Seal the back of electrical boxes in sound insulated construction airtight using specified resilient sealer pads.
 - 3. Conceal caulking and sealing where possible; where caulking must remain exposed, use skinning type material and neatly tool.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Cementitious Backing Board: Install over wood framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- E. Installation on Wood Framing: For nonrated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.

- F. Installation over concrete curbs: adhesive application

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Corner Beads: Install at external corners, using longest practical lengths.
- B. Edge Trim: Install at exposed edges and ends and at untrimmed joints where gypsum board abuts dissimilar materials. Where edge trim is required at wallboard edge, and headers, studs, still or other backing are not available for positive fastening of trim, apply trim to board with contact type adhesive..
- C. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

3.05 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.06 CLEANING

- A. Do not allow the accumulation of scraps and debris arising from the work of this Section but maintain the premises in a neat and orderly condition. In the event of spilling or splashing compound onto other surfaces, immediately remove the spilled or splashed material and trace residue to the approval of the Architect.

END OF SECTION

**Section 09 2216
Non-Structural Metal Framing**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal partition framing.
- B. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Metal fabrications attached to stud framing.
- B. Section 05 5000 - Metal Fabrications: Execution requirements for anchors for attaching work of this section.
- C. Section 06 1000 - Rough Carpentry: Wood blocking within stud framing.
- D. Section 07 2100 - Board and Batt Insulation: Acoustic insulation.
- E. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings.
- F. Section 07 8400 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.
- G. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- H. Section 08 3100 - Access Doors and Panels.
- I. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.
- J. Section 09 2116 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

1.03 REFERENCE STANDARDS

- A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- C. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2025.
- H. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 - 1. CEMCO; ____: www.cemcosteel.com/#sle.
 - 2. ClarkDietrich; ____: www.clarkdietrich.com/#sle.
 - 3. Simpson Strong Tie; ____: www.strongtie.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

- A. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf. Steel 16 gauge and thicker shall be 50 ksi.
 - 1. Studs: C-shaped with flat faces.
 - 2. Studs: C-shaped with triangular-shaped, lipped holes.
 - 3. Runners: U-shaped, sized to match studs.
 - 4. Furring: Hat-shaped sections, minimum depth of 1-1/2 inch.
 - 5. Steel Angle: 90-degree angle-shaped sections, minimum leg length of 3/4 inch.
- B. Non-Loadbearing Framing Accessories:

1. Sheet Metal Backing: 25 gauge, 0.0209 inch thick.
2. Fasteners: ASTM C1002 self-piercing self-tapping screws.
3. Anchorage Devices: Powder actuated.
4. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness 6 ____ inch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.

3.02 INSTALLATION OF STUD FRAMING

- A. Install non-structural members in accordance with ASTM C754.
- B. Extend partition framing to structure in all locations.
- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- E. Fire-Resistance-Rated Construction: Install framing and accessories in accordance with requirements of fire-resistance-rated assembly and to GA-600 requirements.
- F. Align and secure top and bottom runners at 16 ____ inches on center unless noted otherwise on plans.
- G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- H. Install studs vertically at spacing indicated on drawings.
- I. Align stud web openings horizontally.
- J. Secure studs to tracks using crimping method. Do not weld.
- K. Stud splicing is not permissible.
- L. Fabricate corners using a minimum of three studs.
- M. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

- N. Coordinate erection of studs with requirements of door frames, window frames, and equipment anchorage; install supports and attachments.
- O. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- P. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.
- Q. Use sheet metal backing for reinforcement of equipment anchorage.

END OF SECTION

Section 09 2236

Lath

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lath for cement and gypsum plaster.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers: Water-resistive barrier under exterior plaster and stucco.
- B. Section 08 3100 - Access Doors and Panels: Product requirements for metal access panels integral with metal lath.
- C. Section 09 2400 - Cement Plastering.

1.03 REFERENCE STANDARDS

- A. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
- B. ASTM C847 - Standard Specification for Metal Lath; 2018.
- C. ASTM C933 - Standard Specification for Welded Wire Lath; 2023.
- D. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- F. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2023.

1.04 SUBMITTALS

- A. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specifications, provide products as manufactured by one of the following
 - 1. Metal Lath and Accessories:
 - a. Alabama Metal Industries Corporation www.amico-lath.com.
 - b. Cemcow www.cemcosteel.com. (Basis of Design)
 - c. Clarkwestern Dietrich Building Systems LLC www.clarkdietrich.com.
 - d. Fry Reglet: fryreglet.com

2.02 LATH

- A. All lath must be recognized by a current evaluation report issued by ICC ES.
- B. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
 - 1. Weight: 3.4 lb/sq yd.
- C. Ribbed Metal Lath: ASTM C847, galvanized; 3/8 inch thick.
 - 1. Weight: 3.4 lb/sq yd.
- D. Welded Wire Lath: ASTM C933; galvanized per ASTM A641/A641M; with 1 1/2 inch by 1 1/2 inch openings
 - 1. 17 gauge wire
 - 2. Self furring depth: 3/16 inch minimum
 - 3. Self furring spacing: 3 inches on center
- E. Strip Mesh: Expanded metal lath, same weight as diamond mesh lath, 4 inch wide by 24 inch long; galvanized.
- F. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.
 - 1. Material: Aluminum, 6063 T5 alloy, clear anodized
 - 2. Casing Beads with Weep Holes: Square edges.
 - 3. Corner Beads: Straight corners.
 - a. Products:
 - 1) Clark Dietrich; Wire Corner Reinforcement.
 - 2) Clark Dietrich; V Truss Corner Reinforcing.
 - 3) Cemco; Cemcorner.
 - b. Galvanized wire
 - 4. Base Screeds:
 - a. Products:
 - b. 7/8 inch ground
 - c. 26 ga.
 - d. Galvanized
 - e. 3 1/2 inch minimum vertical attachment flange

5. Reveal Joints: One piece with vertical sides.
 - a. Size: Width varies, 1 inch and 3 inch, see architectural elevations for locations.
 - b. Material: 6063 T5 aluminum
 - c. Color: Clear anodized
 - d. Product: Fry Reglet, PA.1

2.03 ACCESSORIES

- A. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized and conforming with ASTM C-1063
- B. Fasteners: Self-piercing tapping screws; ASTM C1002 or ASTM C954.
- C. Line Wire: 18 gauge steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the substrate to apply the metal lath framing is free of gaps, protrusions or other foreign objects that would impair the integrity of the stucco membrane. If stucco system will be applied over wood sheathing, verify the sheathing has a 1/8" gap on all edges of every sheet. Do not begin work unless this condition exists.
- B. Do not begin until unacceptable conditions have been corrected.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION - GENERAL

- A. Install lath and furring for Portland cement plaster in accordance with the ESR for submitted product and according to manufacturer's recommendations.

3.03 CONTROL AND EXPANSION JOINT INSTALLATION

- A. Control Joint Spacing: 8 feet on center vertically, horizontally and otherwise as indicated on drawings..

3.04 LATH INSTALLATION

- A. Apply metal lath as per ICC report and as indicated below.
- B. Apply lath taut, with long dimension perpendicular to supports.
- C. Lap ends minimum 2 inch. Secure end laps with tie wire where they occur between supports.

- D. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
- E. Place corner bead at external wall corners; fasten at outer edges of lath only.
- F. Place base screeds at termination of plaster areas; secure rigidly in place.
- G. Place 4 inch wide strips of lath centered over junctions of dissimilar backing materials, and secure rigidly in place.
- H. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
- I. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
- J. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- K. Weep Screeds: The #7 FHA flange shall be installed over the first layer on substrate and under the second layer of Grade D paper, running the paper down the 3.5" flange.
- L. Horizontal lath: Horizontal lath shall be either flat ribbed metal lath or alternate product complying with ASTM C 847
 - 1. Structa Wire VTruss Walls & Ceiling, ESR 2017 is an approved alternate

END OF SECTION

**Section 09 2400
Cement Plastering**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cement plastering.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood stud framing for plaster.
- B. Section 07 9200 - Joint Sealants
- C. Section 09 2236 - Lath: Lath, furring, beads, screeds, and joint accessories for plaster base.
- D. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- B. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters; 2015 (Reapproved 2020).
- C. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2023a.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittals procedures.
- B. Product Data: Provide data on plaster materials and trim accessories.
- C. Samples:
 - 1. Submit two samples, 24 by 24 inch in size illustrating finish color and texture.
(Note texture and color sample may be applied to gypsum board or cement backer board)

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 MOCK-UPS

- A. Construct mock-up of exterior wall, 8 feet long by 8 feet wide, illustrating surface finish.
 - 1. Locate where directed.
 - 2. Mock-up may remain as part of this work.

1.07 FIELD CONDITIONS

- A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

PART 2 PRODUCTS

2.01 CEMENT PLASTER APPLICATIONS

- A. Lath Plaster Base: Metal lath.
 - 1. Plaster Type: Factory prepared plaster mix.
 - 2. Number of Coats: Three.
 - 3. First Coat: Apply to a nominal thickness of 3/8 inch.
 - 4. Second Coat: Apply to a nominal thickness of 3/8 inch.
 - 5. Finish Coat: Apply to a nominal thickness of 1/8 inch.
 - a. Texture: Sand fine.
 - 6. Finish: Acrylic.

2.02 FACTORY PREPARED CEMENT PLASTER

- A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.
- B. Premixed Textured Coating: Polymer modified acrylic coating, integrally colored, and trowel applied to substrates prepared in accordance with manufacturer's written installation instructions.
 - 1. Color: As indicated on drawings.
 - 2. Manufacturers:
 - a. Parex USA Inc; AquaSol Swirl Fine: www.parex.com
 - b. Sto Corp; Powerflex Fine: www.stocorp.com

2.03 ACCESSORIES

- A. Lath: See Section 09 2236.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

3.02 MIXING

- A. Mix only as much plaster as can be used prior to initial set.
- B. Mix materials dry, to uniform color and consistency, before adding water.
- C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.03 APPLICATION

- A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.
- B. Base Coats:
 - 1. Apply base coat(s) to fully embed lath and to specified thickness.
 - 2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.
- C. Leveling Coat:
 - 1. Apply leveling coat to specified thickness.
 - 2. Fully embed reinforcing mesh in leveling coat.
- D. Finish Coats:
 - 1. Cement Plaster or Acrylic Plaster:
 - a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
 - b. Apply desired surface texture while mix is still workable.

3.04 TOLERANCES

- A. Maximum Variation from True Flatness: 1/4 inch in 10 feet.

3.05 REPAIR

- A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

END OF SECTION

**Section 09 5100
Acoustical Ceilings**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 23 0500 - Common Work Results for HVAC: Air diffusers in ceiling
- B. Section 26 5100 - Interior Lighting
- C. Section 26 0000 Fire Alarm

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.
- C. IR 25-2.13 - Metal Suspension System for Lay-In Panel Ceiling; 2017.
- D. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.

- C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.
- E. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: 80 sq ft of each type and size.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.
- B. Before installing canopies, permit them to reach room temperature and a stabilized moisture content.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: Basis of Design www.armstrong.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. USG Corporation: www.usg.com.
 - 4. Or equal.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. Certainteed Architectural; ____: www.certainteed.com/ceilings-and-walls/#sle.
 - 3. USG Corporation; (Basis of design): www.usg.com/ceilings/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

- A. Acoustical Panels Lay in ceiling panels: Painted mineral fiber, with the following characteristics:

1. Classification: ASTM E1264 Type III.
 2. Size: 24 by 48 inches and 24 by 48 inches as depicted on Drawings.
 3. Thickness: 15/16" inch.
 4. NRC Range: 70, determined in accordance with ASTM E1264.
 5. Ceiling Attenuation Class (CAC): 40, determined in accordance with ASTM E1264.
 6. Panel Edge: Square.
 7. Suspension System: Exposed
 8. Products:
 - a. Armstrong World Industries, Inc; Ultima Square Lay in:
www.armstrongceilings.com/#sle.
 - b. USG Corporation; Radar Education Acoustical Panels: High Durability Panels
www.usg.com/ceilings/#sle.
 - c. Or equal..
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Panels, Type Adhered ceiling tiles: Painted mineral fiber, with the following characteristics:
1. Application(s): Direct apply.
 2. Classification: ASTM E1264 Type A, Class A Fire Rating.
 3. Fire Performance: Class A when tested in accordance with ASTM E84.
 4. Size: 12 by 12 inches.
 5. Thickness: 5/8 inch.
 6. Panel Edge: Beveled.
 7. Color: White.
 8. Products:
 - a. Armstrong World Industries, Fine Fissured 746, Beveled Edge.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SUSPENSION SYSTEM(S)

- A. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 2. Profile: Tee; 15/16 inch face width.
 3. Finish: Baked enamel.
 4. Products:
 - a. USG Corporation; Donn Brand DX/DXL 15/16 inch Acoustical Suspension System:
www.usg.com/ceilings/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

- D. Touch-up Paint: Type and color to match acoustical and grid units.
- E. Adhesive: Henry 237 Acoustigum Acoustical Ceiling Tile Adhesive. Apply per manufacturer's directions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Installation shall be in conformance with IR 25-2.13
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

- J. Form expansion joints per approved details. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces.
- C. Replace damaged or abraded components.

END OF SECTION

This page intentionally left blank

**Section 09 6500
Resilient Flooring**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient base.
- B. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 09 2116 - Gypsum Board Assemblies.
- C. Section 09 6813 - Tile Carpeting.

1.03 REFERENCE STANDARDS

- A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- B. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

1.05 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 RESILIENT BASE

2.02 ACCESSORIES

- A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
 - 1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.
- B. Adhesive for Rubber Flooring:
 - 1. As recommended by manufacturer..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

- A. Prepare substrates as recommended by resilient floor base manufacturers.
- B. Remove substrate ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of substrate conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.

3.04 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.05 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

This page intentionally left blank

Section 09 9113
Exterior Painting

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed steel surfaces such as structural steel elements
 - 2. Exposed galvanized metal surfaces such as sheet metal flashing, vents, and trim.
 - 3. Roof accessories and exposed elements on the roof
 - 4. Exposed edge of slab or curb
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, copper, and lead.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 07 4646 Fiber Cement Siding
- B. Section 09 2400 - Portland Cement Plastering
- C. Section 09 9123 - Interior Painting.
- D. Section 32 1723 - Pavement Markings: Painted pavement markings.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- F. South Coast Air Quality Management District (SCAQMD) Rule 1113.
- G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- H. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.
- I. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.05 SUBMITTALS

- A. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
- B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- 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.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer.
- B. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Substitutions: Specified products are a District standard - no substitutions

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of California.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: As indicated on drawings.
 - 1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to District.
 - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 EXTERIOR SCHEDULE - NEW CONSTRUCTION

- A. Concrete and plaster:
 - 1. 1st Coat: Loxon Exterior Acrylic Masonry Primer A24W8300
 - 2. 2nd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
 - 3. 3rd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
- B. Concrete - curbing:
 - 1. 1st Coat: Pro-Park Waterborne Traffic Marking Paint B97 Series
 - 2. 2nd Coat: Pro-Park Waterborne Traffic Marking Paint B97 Series
- C. Wood - fascia, eaves and trim:
 - 1. 1st Coat: Pro-Block Int/Ext Acrylic Primer B51W620 Series
 - 2. 2nd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
 - 3. 3rd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
- D. Fiber Cement - fascia and trim:
 - 1. 1st Coat: Pro-Block Int/Ext Acrylic Primer B51W620 Series
 - 2. 2nd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
 - 3. 3rd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
- E. Galvanized Metal - gutter, downspouts, flashing, exposed conduit:
 - 1. Pretreatment: Jasco Metal Prep & Primer
 - 2. 1st Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series
 - 3. 2nd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series
 - 4. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series
- F. Ferrous Metal - doors & frames, structural steel, steel fascia, columns, canopy structures, canopy ceilings and miscellaneous ferrous metal:
 - 1. 1st Coat: Shop applied primer
 - 2. 2nd Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series
 - 3. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series

4. 4th Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. 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. Exterior Plaster and Stucco: 12 percent.
 - 2. Fiber Cement Siding: 12 percent.
 - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.

- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
 - 3. Repair any spalling or cracking. Allow sufficient time for repairs to cure before painting.
 - 4. Clean concrete according to ASTM D4258. Allow to dry.
 - 5. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- I. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- J. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- K. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- L. All surfaces exhibiting mold/mildew shall be treated with a solution of bleach and water. Mix 3 parts clean water with 1 part bleach and apply to effected surfaces. Allow solution to remain on surface for 15 minutes prior to rinsing with clean water.
- M. All surfaces to receive paint and all surfaces with the bleach solution shall be pressure washed with a minimum of 2400 psi to remove all loose and peeling paint, mold, mildew, loose/flaky rust, dirt, chalk and any other surface contamination.
- N. Any loose and peeling paint, rust and other surface contamination shall be removed with hand or power tool cleaning to a tightly adherent paint film or rusty surface.
- O. Glossy surfaces, such as gutters, downspouts, doors, door frames and windows shall be sanded to remove gloss prior to priming.
- P. Reset any loose nails at all wood fascia/trim areas.

- Q. Spot prime rusty nail heads with Rust Destroyer aerosol rust-inhibiting primer prior to priming/finish coating.
- R. Remove all failed sealant and recaulk using NP1 Sealant - exterior application only.
- S. Follow all manufacturers' written instructions on application, application temperatures and re-coat times.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- E. Mask off and paint metal access doors and other trim located within or adjacent to other surfaces with appropriate paint per schedule above.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect adjacent surfaces not being painted.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

This page intentionally left blank

**Section 09 9123
Interior Painting**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Ceramic and other tiles.
 - 8. Glass.
 - 9. Acoustical materials, unless specifically indicated.
 - 10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 08 1416 - Wood Doors
- C. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.05 SUBMITTALS

- A. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. Cross-reference to specified paint system products to be used in project; include description of each system.
- B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
 - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
 - 4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished metals and wood cabinets, have been approved.
- C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- 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.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer.
- B. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 2. Vista Paint Corporation: www.vistapaint.com/#sle.
 - 3. Dunn Edwards.
- C. Substitutions: Approved equ.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

- B. Volatile Organic Compound (VOC) Content: See Section 01 6116.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: As indicated on drawings.
 - 1. Allow for minimum of two colors for each system, unless otherwise indicated, without additional cost to District.
 - 2. Extend colors and sheens to surface edges; colors may change at any edge as directed by Architect.
 - 3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 INTERIOR SCHEDULE - NEW CONSTRUCTION

- A. Drywall - walls & ceilings - all areas:
 - 1. 1st Coat: Pro Mar 200 VOC Interior Acrylic Primer B28W2600.
 - 2. 2nd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
 - 3. 3rd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
- B. Ferrous Metal - doors & frames and miscellaneous ferrous metal:
 - 1. 1st Coat: Shop applied primer.
 - 2. 2nd Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series.
 - 3. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
 - 4. 4th Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
- C. Galvanized metal - only paint metal 8' and above:
 - 1. Pretreatment: Jasco Metal Prep & Primer.
 - 2. 1st Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series.
 - 3. 2nd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
 - 4. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
- D. Concrete:
 - 1. 1st Coat: Loxon Int/Ext Acrylic Masonry Primer A24W8300.
 - 2. 2nd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
 - 3. 3rd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
- E. Concrete - floors at utility closets:
 - 1. 1st Coat: Macropoxy 646 Fast Cure Epoxy B58W610/B58V600 Series.
 - 2. 2nd Coat: Macropoxy 646 Fast Cure Epoxy B58W610/b58V600 Series.
- F. Wood - paint-grade:
 - 1. 1st Coat: Premium Interior Acrylic Wall & Wood Primer B28W8111.
 - 2. 2nd Coat: Pro Classic Interior Acrylic Semi-Gloss Enamel B31W1151 Series.
 - 3. 3rd Coat: Pro Classic Interior Acrylic Semi-Gloss Enamel B31W1151 Series.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- F. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.

- 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- G. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- H. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

END OF SECTION

Section 10 1400

Signage

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room identification signs
- B. Restroom door signs

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. CBC Chapter 11B - California Building Code - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing; 2022.
- D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- E. NFPA 170 - Standard for Fire Safety and Emergency Symbols; 2021.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Shop Drawings and Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from District through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by District through Architect prior to fabrication.

- D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flat Signs:
 - 1. Best Sign Systems, Inc: www.bestsigns.com. Basis of Design
 - 2. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
 - 3. Seton Identification Products: www.seton.com/aec.
- B. Dimensional Letter Signs:
 - 1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com
 - 2. A.R.K. Ramos; Cast Aluminum: www.arkramos.com

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with CBC Chapter 11B, ADA Standards, and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room Identification Signs: As indicated on drawings
 - 1. Sign Type: Flat signs with applied character panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.

3. Character Height: 5/8 inch.
 4. Sign Height: 4 inches, unless otherwise indicated.
 5. Classrooms: Identify with the room numbers indicated on drawings.
 6. Restrooms: Identify as "ALL-GENDER", and duplicate in braille.
- C. Restroom Door Plaques: Provide superimposed geometric symbols that comply with applicable requirements of CBC 11B-703.7.2.6 and as indicated on drawings.
1. Sign Type: Laminated colored acrylic
 2. Non-tactile sign

2.03 SIGN TYPES

- A. Flat Signs: Signage media without frame.
1. Edges: Square.
 2. Corners: Radiused.
 3. Wall Mounting of One-Sided Signs: Stainless steel vandal-proof pin-in-head torx screw surface mounted to wall with concealed anchors.
- B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
 2. Character Case: Upper case only.
 3. Background Color: As scheduled.
 4. Character Color: White color.

2.04 TACTILE SIGNAGE MEDIA

- A. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
1. Total Thickness: 1/8 inch.
 2. Letter Thickness: 1/8 inch.
 3. Letter Edges: Square.

2.05 NON-TACTILE SIGNAGE MEDIA

- A. Color coated acrylic plastic sheet: Use nonfading colored coatings recommended by acrylic manufacturer for optimum adherence to surface.
1. Sign Color: #204 Bright White circle; #902 Pine Green triangle
 2. Thickness: 1/4" thick triangle superimposed on a 1/4" thick circle

2.06 ACCESSORIES

- A. Exposed Screws: Stainless steel.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with CBC Chapter 11B, ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

3.03 FIELD INSPECTION

- A. Per CBC Chapter 11B signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per Chapter 1, Division II, Section 111, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with these regulations.

END OF SECTION

**Section 10 4400
Fire Protection Specialties**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Roughed in wall openings

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Provide extinguisher ratings and classifications and color and finish.
- C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
 - 2. Larsen's Manufacturing Co; MP5 - Basis of Design: www.larsensmfg.com.
 - 3. Potter-Roemer; 3005: www.potterroemer.com/#sle.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Academy Series: www.activarcpg.com/#sle.

2. Larsen's Manufacturing Co; Architectural Series - Basis of Design:
www.larsensmfg.com.
 3. Potter-Roemer; Alta Series #7042: www.potterroemer.com.
- C. Fire extinguishers and cabinets shall be furnished from single manufacturer.
- D. Cabinets shall meet CBC requirements for mounting height and projection from wall.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Stored Pressure Operated: Deep Drawn.
 2. Class: A:B:C type.
 3. Size: 5 pound.
 4. Finish: Baked polyester powder coat red color.
 5. Model: MP5 as manufactured by Larsen's
 6. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Cabinet Configuration: Semi-recessed type.
1. Size to accommodate accessories.
 2. Trim: 2-1/2" Rolled edge
- B. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- C. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- D. Finish of Cabinet Exterior Trim and Door: clear anodized.
- E. Finish of Cabinet Interior: Clear anodized aluminum.
- F. Lettering: Vertical, Red
- G. Model: Larsen's Architectural Series AL 2409-6R Vertical Duo

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, maximum 48" inches from finished floor to top of cabinet pull handle.

END OF SECTION

This page intentionally left blank

Section 12 3600

Countertops

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Section 06 4100 - Architectural Wood Casework

1.03 REFERENCE STANDARDS

- A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2025.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- D. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168 Adhesive and Sealant Applications; current edition; www.aqmd.gov.
- E. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. A. Fabricator and Installer Qualifications: Minimum [2] years experience in work of this Section.

1.06 WARRANTY

- A. Concrete Countertops: Provide manufacturer's 5 year warranty against defects in materials and workmanship.

1.07 FIELD 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
 - 1. Manufacturers:
 - a. Durcon, Inc, _____: www.durcon.com/#sle.
 - b. OnePointe Solutions LLC; Epoxy Resin Countertops: www.onepointesolutions.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Flat Surface Thickness: 1 inch, nominal.
 - 3. Chemical-Resistance: Provide products that resist the following chemicals with not more than Moderate Effect when tested in accordance with NEMA LD 3:
 - 4. Flammability: Self-extinguishing, when tested in accordance with ASTM D635.
 - 5. Surface Finish: Smooth, non-glare.
 - 6. Color: Black.
 - 7. Exposed Edge Shape in Sink Areas: Built-up marine edge 1/4 inch higher than counter by 1 inch wide.
 - 8. Back and End Splashes: Same material, same thickness; separate for field attachment.

2.02 ACCESSORY MATERIALS

- A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- B. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Plumber to provide cut out templates and countertop fabricator to prepare cut out for sink, whether rim set or bottom mounted, as well as fixtures.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach epoxy resin countertops using compatible adhesive.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 CLEANING

- A. Clean countertops surfaces thoroughly.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**Section 22 0500
Common Work Results for Plumbing**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic Mechanical Requirements specifically applicable to Division 22 Sections, in addition to the general requirements.
- B. Plumbing work includes the following: furnish and install all piping and plumbing fixtures shown on the plumbing, mechanical, and architectural drawings described in these specifications. In connection with this work, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said systems properly and safely operable, including, but not limited to, support hardware, insulation, valves, flashing, cleanouts, cutting and patching.

1.02 WORK SEQUENCE

- A. Install work in phases to accommodate Owner's construction requirements. Refer to Architectural, Structural, and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.
- B. Coordinate related work and modify surrounding work as required.

1.03 SUBMITTALS

- A. Submit on the following:
 - 1. All pipe, fittings, insulation, hangers and supports, labels, fixtures, adhesives and sealants, and equipment that is planned to be installed on this project.
- B. Proposed Products List: Include Products specified in the following Sections:
 - 1. Division 22 - Plumbing.
 - 2. Project Drawings.
- C. Submit product data grouped to include complete submittals of related systems, products, and accessories in a single submittal bound in a three ring binder with table of contents and section tabs. See General Conditions and other sections for additional submittal requirements. Submittals shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.
- D. Equipment and materials shall be ordered only after satisfactory review by Architect and Engineer.
- E. The following statement applies to all items reviewed: "Checking is only for general conformance with the design concept of the project and general compliance with the

information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work.”

- F. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.
- G. The first submittal shall be comprehensive and complete. Partial submittals will be returned without review.

1.04 REGULATORY REQUIREMENTS

- A. Conform to 2022 California Building Code.
- B. Fire Protection: Conform to 2022 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.
- C. Plumbing: Conform to 2022 California Plumbing Code.
- D. Mechanical: Conform to 2022 California Mechanical Code.
- E. Electrical: Conform to 2022 California Electrical Code.
- F. Obtain approved inspections from authority having jurisdiction.
- G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.05 PROJECT / SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of Owner before proceeding.
- C. Piping Locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes.
- D. Construction Observation: In addition to the requirement for obtaining inspections by the local jurisdiction, Contractor shall notify Engineer and commissioning agent at appropriate times during the construction process so that they can visit site to become generally familiar with the progress and quality of Contractor’s work and to determine if the work is proceeding in general accordance with the contract documents.

- E. Scaling of Drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime Contractor shall request in writing that the Architect or the Engineer provide clarification or the specific dimension.

1.06 QUALITY ASSURANCE

- A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.
- B. Qualification of Installer: Use adequate number of skilled workmen, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications.
- C. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power-using equipment shall meet the California energy efficiency standards as defined in the current Title 24 requirements.
- D. Welding procedures and testing shall comply with ANSI Standard B31.1.0 standard code for pressure piping and the American Welding Society – Welding Handbook. Welding shall also comply with Division of the State Architect and structural plan requirements for materials, procedures, qualifications, and inspections.

1.07 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, the contractor shall immediately and before commencing work, request clarification from Engineer.
- B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and the sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.
- C. In case of conflicts not clarified prior to bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award, and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".
- E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

1.08 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 - PRODUCTS

2.01 PRODUCTS

- A. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- B. Provide products and materials that are new, clean, free from defects, damage, and corrosion.
- C. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.
- D. Protect materials stored at site and installed from damage. Verify dimensions of equipment and fixtures prior to ordering. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.
- B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences. Provide offsets as needed to avoid other trades.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.
2. Provide offsets, transitions, and changes in directions of pipes as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required. It is the intent of this paragraph that all cost associated with compliance be borne by the contractor.
3. All equipment shall be firmly anchored to building structural elements per DSA approved plans.
4. Carefully check space requirements with other trades and existing conditions to ensure material, fixtures or equipment can be installed in the spaces allotted. Coordination is required and essential.

3.2 FIRESTOPPING

- A. Firestop all penetrations of rated elements with approved firestop material such as Hilti FS-1 per manufacturer's plates. Provide plates to project inspector prior to installation.

END OF SECTION

Project Name: Oxnard College OE Building Alterations

Job Number: 3244-01-ED24

Section 22 0500

This Page Blank

**Section 22 0510
Plumbing Piping**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings, notes, and general provisions of the Contract, including General and Supplemental Conditions apply to this section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for domestic water, waste, and vent.
 - 2. Escutcheons.
 - 3. Cleanouts.
 - 4. Vandal-proof vent caps.
 - 5. Supply tubes.

1.03 REFERENCES

- A. ANSI B31.9 - Building Service Piping.
- B. ASME B16.3 - Malleable Iron Threaded Fittings.
- C. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- D. ASTM A47 - Ferritic Malleable Iron Castings.
- E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- F. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- G. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
- H. ASTM B32 - Solder Metal.
- I. ASTM B88 - Seamless Copper Water Tube.
- J. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- K. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- L. ASTM D2241 - Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).
- M. ASTM D2466 - Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

- N. ASTM D2564 - Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
- O. ASTM D2855 - Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.
- P. ASTM D3034 - Poly Vinyl Chloride (PVC) Plastic Sewer Pipe SDR-35.
- Q. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- R. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- S. ASTM D2513 - SDR11.5 Polyethylene Gas Pipe.

1.04 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Piping and fittings.
 - 2. Escutcheons.
 - 3. Cleanouts.
 - 4. Vandal-proof vent caps.
 - 5. Supply tubes.
- B. Project Record Documents
 - 1. Submit the following:
 - 2. Record actual locations of valves and piping.
- C. Operation and Maintenance Data
 - 1. Submit the following:
 - 2. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with 2022 California plumbing code.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of the general requirements.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER PIPING, ABOVE GROUND

- A. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper. US – Manufactured.
 - 1. Wrought-copper solder-joint fittings: ASME B16.22, wrought-copper pressure fittings, with lead-free solder.
 - 2. Bronze Flanges: ASME B16.24, class 150, with solder-joint ends.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.02 SANITARY WASTE AND VENT PIPING

- A. Hubless cast-iron pipe and fittings: ASTM A888 or CISPI 301. US – Manufactured.
- B. All sewer and vent piping within building and out 5 feet beyond the building shall be no-hub cast iron.
- C. Standard shielded couplings, stainless steel: CISPI 310.
- D. Heavy-duty couplings, stainless steel: ASTM C564. Use four-band clamps at all rainwater piping.
- E. All cast-iron pipe and fittings shall be manufactured in the U.S.
- F. Minimum slope 1/4" per foot to drain with no bellies in piping. All underground waste piping shall be installed per details on plumbing and structural drawings.

2.03 ESCUTCHEONS

- A. Escutcheons for water and waste piping penetrations.
 - 1. Manufacturers: subject to compliance with requirements, provide products by the following: Brasscraft.
 - 2. Description: chrome-plated cast brass with set screws.

2.04 CLEANOUTS

- A. Cleanouts for waste piping.
 - 1. Manufacturers: subject to compliance with requirements, provide products by one of the following:
 - a. J.R. Smith

b. Zurn.

2. Description: cast-iron with threaded bronze plug. 18 gage stainless cover with vandal-proof screws for wall cleanout. Polished brass non-slip cover for floor cleanout.

2.05 VANDAL-PROOF VENT CAPS

A. Vandal-proof vent caps

1. Manufacturers: subject to compliance with requirements, provide products by one of the following:
- a. J.R. Smith
 - b. Zurn.
2. Description: cast-iron dome secured with recessed Allen Key Set screws.

2.06 SUPPLY TUBES

A. Supply tubes:

1. Manufacturers: subject to compliance with requirements, provide products by the following:
- a. Brasscraft.
 - b. No-Burst.
2. Description: braided stainless steel, ½" FIP x ½" compression.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with Manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- I. Establish elevations of buried piping outside the building to ensure not less than 30 inch of cover. Exception: Localized areas may be 18" deep to accommodate existing conditions.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.
- M. Excavate in accordance with this Section for work of this Section.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Seal all penetrations through exterior walls and fire rated walls with 3M Firestopping materials for fire rating capacity per the architectural plans and CPC requirements.
- Q. Test all piping per 2022 California Plumbing Code Requirements.
- R. Disinfect all water piping per AWWA requirements
 - 1. Acceptable Disinfectants
 - a. Sodium Hypochlorite
 - b. Calcium Hypochlorite.
 - 2. Flush system prior to disinfection. Provide connections for adding solution. Add solution to bring system to 25 PPM for 24 hours. Neutralize solution prior to dumping to sewer.
 - 3. Testing Requirements for demonstration of compliance with the Maximum Containment Level (MCLs) of the Safe Drinking Water Act:

- a. Total chlorine concentration of less than 1 mg/L (1 ppm) or incoming water concentration, whichever is greater.
- b. The absence of any coliform bacteria.
- c. Less than 200 non-coliform bacteria per 100 mL sample
- d. Test out all drinking fountains and one sink / lav at each building. Sample shall be taken per lab requirements.

4. Repeat disinfection if test results are not satisfactory.

S. As-built locations of pipe with dimensions from easily identified building elements.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- B. Slope water piping and arrange to drain at low points.

END OF SECTION

**Section 22 0523
General-Duty Valves for Plumbing Piping**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Bronze Ball Valves.
 - 2. Brass angle stops
 - 3. Hydrants.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.03 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.04 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.05 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:

22 0523 – General-Duty Valves for Plumbing Piping

Page 1 of 6

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.
 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.
- D. Lead-free construction per California requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set angle, gate, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- E. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

2.02 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. NIBCO INC. S-685-80-LF to 2"; NIBCO T-FP-600A > 2".
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Sweat.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.03 BRASS ANGLE STOPS

A. Brass angle stops, heavy pattern.

1. Subject to compliance with requirements, provide products by the following:
 - a. Brasscraft.
 - b. Chicago Faucet.
3. Description: Lead-Free, heavy pattern, angle, ½" FIP inlet x ½" compression, loose key.

2.04 HYDRANTS

A. Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. J.R. Smith.

- b. Zurn.
- c. Nibco.
- d. Watts.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.03 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Domestic Water Shutoff Service: Ball valves.
 - 2. Throttling Service: Globe valves.

- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, 2" and Smaller: Soldered ends.
 - 2. For Copper Tubing, 2-1/2" to NPS 4". Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, 2-1/2" and Smaller: Threaded ends.
 - 4. For Steel Piping, 2-1/2" TO 4". Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 5. For Steel Piping, NPS 5 and Larger: Flanged ends.

END OF SECTION

Project Name: Oxnard College OE Building Alterations

Job Number: 3244-01-ED24

Section 22 0523

This Page Blank

Section 22 0529
Hangers and Supports for Plumbing Piping and Equipment

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Equipment supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 PERFORMANCE REQUIREMENTS

- A. Equipment supports shall be capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Design seismic-restraint hangers and supports for piping and equipment per Unistrut OSHPD Pre-Approved OPM-0295-13.
- C. All exterior steel support components shall be hot-dipped galvanized. All welds shall be ground smooth and painted with three coats of zinc-rich paint.

1.05 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Mechanical fastener systems.
 - 4. Pipe positioning systems.
 - 5. Trapeze pipe hangers. Include Product Data for components.
- 22 0529 – Hangers and Supports for Plumbing Piping and Equipment

6. Metal framing systems. Include Product Data for components.
7. Pipe stands. Include Product Data for components.
8. Equipment supports.

B. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.2, "Structural Welding Code--Aluminum."
 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. ERICO/Michigan Hanger Co.
 3. Unistrut
 4. Superstrut
- C. Galvanized, Metallic Coatings: Hot dipped.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.03 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.
1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Unistrut Corp.; Atkore International, Ltd.

2.04 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. Power-Strut Div.; Atkore International, Ltd.
 - 4. Unistrut Corp.; Atkore International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated. Exterior components shall be hot-dipped galvanized.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- E. Provide submittal.

2.06 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated (interior use) Type 304 stainless steel (exterior use), for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Anchor must have ICC report. Provide report with submittal and one copy to the inspector. See State Architect Requirements for testing.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Or equal.
- C. Pre- placed concrete inserts
 - 1. Manufacturers:
 - 22 0529 – Hangers and Supports for Plumbing Piping and Equipment

- a. B-Line Systems, Inc.; a division of Cooper Industries.
- b. or equal.

2.07 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping. See plans for details.
- B. All exterior steel supports shall be hot dipped galvanized.
- C. No piping supports shall be mounted directly on roof membrane.

2.08 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.09 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel supports shall be hot dipped galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install concrete inserts prior to concrete placement per manufacturer's listing.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
- G. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

-
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
 - O. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - 4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

- A. Provide 20 gauge sheet metal backing as needed to support equipment and fixture.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports or 4x between framing with Simpson A-34 clips at each side, both ends..
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 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 welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING & PERSONNEL PROTECTION

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

- B. Trim excess length of continuous-thread hanger and support rods to 1/2 inches below nut.
- C. Provide personnel protection at mechanical rooms, equipment areas and any equipment maintenance area from strut and threaded rods ends. Install soft protective materials to prevent skin and skull injuries. Install protection as soon as practicable after installation.

3.06 PAINTING

- A. Touch Up: Clean and touch up painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- C. Paint to match adjacent surface, verify color with school district. See painting specifications.

END OF SECTION

This Page Blank

**Section 22 0700
Plumbing Insulation**

GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Glass fiber.
- B. Related Sections include the following:
 - 1. Section 22 05 10 - Plumbing Piping.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements,
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000(Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - a. RPR Products, Inc.; Insul-Mate.

2.02 GLASS FIBER

- A. Manufacturers:

1. Owens Corning.
 2. Johns-Manville.
 3. Or equal.
- B. Insulation: ASTM C547; rigid molded, noncombustible.
1. 'K' ('ksi') value: ASTM C335, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 2. Minimum Service Temperature: -20 degrees F (-28.9 degrees C).
 3. Maximum Service Temperature: 300 degrees F (150 degrees C).
 4. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket
1. ASTM C921, White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
 3. Secure with self-sealing longitudinal laps and butt strips.
 4. Secure with outward clinch expanding staples and vapor barrier mastic.
- D. Tie Wire: 18 gage stainless steel with twisted ends on max. 12 inch (300 mm) centers.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
 - 1. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

6. All sealants and adhesives to be field-applied, within the building envelope must comply with state and local VOC limits.
7. Install pipe insulation that is suitable to be painted. Paint all exposed pipes, insulation, and all piping supports to match adjacent surface. Verify color with school district. See painting specifications.

3.06 GLASS FIBER INSULATION SCHEDULE

PIPING SYSTEMS	PIPE SIZE	THICKNESS
	Inch (mm)	Inch (mm)
Plumbing Systems	1/2"-1-1/2"	1"
Domestic Hot Water Supply	1/2"-1-1/4"	1"
Domestic Hot Water Recirculation	1/2"-3/4"	1"
Concealed condensate	3/4"	1"

END OF SECTION

**Section 22 4000
Plumbing Fixtures and Equipment**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following plumbing fixtures, equipment, and related components:
 - 1. Sink.

1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.04 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

- B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

- A. Accessible Plumbing Fixture Regulatory Requirements: Accessible plumbing fixtures shall comply with all of the requirements of 2022 CBC Chapter 11B.
- B. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in 2022 CEC, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Vitreous-China Fixtures: ASME A112.19.2M.
 - 3. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Faucets: ASME A112.18.1.
 - 2. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 3. NSF Potable-Water Materials: NSF 61.
 - 4. Pipe Threads: ASME B1.20.1.
 - 5. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - 6. Supply Fittings: ASME A112.18.1.

7. Brass Waste Fittings: ASME A112.18.2.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 1. Brass Waste Fittings: ASME A112.18.2.
 2. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 1. Flexible Water Connectors: ASME A112.18.6.
 2. Floor Drains: ASME A112.6.3.
 3. Hose-Coupling Threads: ASME B1.20.7.
 4. Hot-Water Dispensers: ASSE 1023 and UL 499.
 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 6. Pipe Threads: ASME B1.20.1.
 7. Plastic Toilet Seats: ANSI Z124.5.
- L. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.01 SINK

- A. Sink:
 1. Manufacturers: subject to compliance with requirements, provide products by the following:
 - a. Elkay
 2. See Plumbing Schedule

2.02 FAUCET

- A. Faucet:
 1. Manufacturers: subject to compliance with requirements, provide products by the following:
 - a. Chicago Faucet
 - b. Elkay

2.03 PROTECTIVE SHIELDING COVERS

- A. Protective Shielding Pipe Covers:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Truebro Guard.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install fixtures level and plumb according to roughing-in drawings.
- C. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- D. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- E. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
- F. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- G. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."
 - 1. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits in Division 01 Section "Indoor Air Quality (IAQ) Management".

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

END OF SECTION

Project Name: Oxnard College OE Building Alterations

Job Number: 3244-01-ED24

Section 22 4400

This Page Blank

Section 23 0500
Common Work Results for HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic Mechanical Requirements specifically applicable to Division 23 Sections, in addition to the General Requirements.
- B. Mechanical work includes the following: furnish and install all mechanical equipment shown on the mechanical, plumbing, architectural, electrical, and civil engineering drawings and described in these specifications. Contractor shall furnish and install, make operable, and test all mechanical equipment shown on the plans. In connection therewith, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said equipment properly and safely operable, including but not limited to, mounting hardware and framing, insulation, duct systems, flashing, piping, valves, systems, energy management systems, cutting and patching.

1.02 WORK SEQUENCE

- A. Install work in phases to accommodate Owner's construction requirements. Refer to Architectural, Structural, Civil, and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.

1.03 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work as required.

1.04 SUBMITTALS

- A. Submit the following:
- B. Proposed Products List: Include Products specified in the following Sections:
 - 1. Section 23 - Mechanical.
 - 2. Project Drawings
- C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. Submittals shall be specific to the fixtures/device/unit being submitted; the data shall be highlighted or marked to be quite clear as to the fixtures/devices/units that shall be provided.

- D. Equipment and materials shall be ordered only after satisfactory review by Owner and Engineer.
- E. The following statement applies to all items reviewed. "Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work."
- F. Contractor shall clearly mark the submittal sheet as to which model number, size, color, etc. when there is more than one choice available.
- G. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.
- H. Submittals shall have table of contents organized by specification section and shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.

1.05 REGULATORY REQUIREMENTS

- A. Conform to 2022 California Building Code.
- B. Fire Protection: Conform to 2022 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.
- C. Plumbing: Conform to 2022 California Plumbing Code.
- D. Mechanical: Conform to 2022 California Mechanical Code.
- E. Electrical: Conform to 2022 California Electrical Code.
- F. Obtain approved inspections from authority having jurisdiction.
- G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.06 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of owner before proceeding.
- C. Piping locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance

with codes. It is not the intent of the drawings to show necessary offsets required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.

- D. Construction observation: In addition to the requirement for obtaining inspections by the local jurisdiction, contractor shall notify Engineer at appropriate times during the construction process so that Engineer can visit site to become generally familiar with the progress and quality of contractor's work and to determine if the work is proceeding in general accordance with the contract documents.
- E. Scaling of drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime contractor shall request in writing that the architect or engineer provide clarification or the specific dimension.
- F. As equal: For an item to be substituted "as equal" the contractor must provide to the engineer a complete submittal no later than 7 days prior to the bid opening. Contractor shall be responsible for any cost associated with the change including architectural design, mechanical, structural and electrical engineering and changes in any element of the building.
- G. Unit and duct locations: Heating and air conditioning unit and duct locations shown are approximate only. Contractor shall verify locations of all structural members, other trades, and existing conditions in the field, and locate units and ductwork to avoid interference. All clearances required by unit manufacturer shall be maintained. Entire installation shall be in accordance with codes and the recommended installation procedures published by the manufacturers. It is not the intent of the drawings to show necessary offsets and transitions required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.
- H. Contractor will verify with owner and site conditions the exact existing roofing system in place and provide compatible roofing materials and products. Contractor to provide written statement regarding existing roofing system and proposed roofing system and provide manufacturer information prior to procurement and installation.
- I. Proceed with roofing work only when existing and forecasted weather conditions will permit a unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.
- J. Flashings 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. Complete flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- K. Patching Materials, General: As required for original installation and to match surrounding construction.
 - 1. Contractor shall provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing.
 - 2. Generally, the Contract Documents will not define products or standards of workmanship present in existing construction. Contractor shall determine products by inspection and

necessary testing and determine quality of workmanship by using existing as a sample for comparison.

3. The presence of a product, finish, or type of construction requires that patching, extending or matching shall be performed as necessary to make work complete and consistent with identical standards of quality.

L. Patching of Building Finish Materials: Contractor shall match existing products and finishes. Contractor shall confirm colors, patterns, and textures with Architect/Owner. The contractor shall custom cut new materials to fit and to match joint patterns with existing materials. The contractor shall custom cut new materials to size to match existing constructions.

M. Patching of Roof: Contractor shall patch and match existing adjacent surface. Where penetrations have occurred to finish surface to remain, contractor shall patch penetrations and repair. Restore exposed finishes of patch areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing. All shall be performed by a licensed roofing contractor.

1.07 QUALITY ASSURANCE

- A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.
- B. Qualification of Installer: Use adequate number of skilled workman, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications. Engage an experienced installer to perform work who has specialized in installing roofing similar to that required for this project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.
- C. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- D. Provide products and materials that are new, clean, free from defects, damage, and corrosion.
- E. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.
- F. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power using equipment shall be meet the California energy efficiency standards as defined in the current Title 24 requirements.

1.08 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, immediately and before commencing work, request clarification from Engineer.

- B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.
- C. In case of conflicts not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".
- E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

PART 2 – NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.
- B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences.
 - 1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.
 - 2. Provide offsets, transitions, and changes in directions of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required.
- C. All equipment shall be firmly anchored to building structural elements.
- D. Install all equipment to permit proper service of equipment. Arrange pipes, ducts, conduits, etc to allow accessibility to equipment.
- E. Do not install equipment, pipes, or ducts above electrical room
- F. Install accessible plumbing fixtures at height shown on architectural drawings. Report any discrepancies or layout issues to Architect promptly.

3.02 COORDINATION OF WORK

- A. The contract documents establish scope, materials, and quality but are not detailed installation instructions. Drawings are diagrammatic.
- B. The contract documents show the general arrangement of equipment, ductwork, piping, and accessories. Provide offsets, fittings, and accessories which may be required but are not shown on the drawings. Investigate the site and review the other trades installation locations and requirements to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
- C. Whenever work interconnects with the work of other trades, coordinate to insure that all parties concerned have the necessary information required for a proper installation.
- D. Provide access doors as required to allow service and accessibility to valves, dampers, coils, etc. Install fire rated access doors in rated assemblies. Coordinate with framing and ceiling contractors.
- E. Furnish and set sleeves for passage of pipes, ducts, and conduits that pass through structural masonry and concrete walls, roofs, floors and elsewhere as required for the proper protection of each item passing through the building elements. See structural drawings for further details.
- F. Install UL Approved firestopping around all pipes, conduits, ducts, etc which pass through rated walls, partitions, and floors in strict accordance with manufacturer's listing and element rating.

3.03 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

- A. Provide two copies of all operating and maintenance manuals to owner. Include parts lists and suppliers' names and phone numbers.
- B. Provide four hours of training to the owner for the proper operation (start-up, operation, and shutdown) and servicing of the installed equipment. Provide three weeks notice to the owner and engineer of the date of the training. Arrange for subcontractors to attend and participate where applicable.

3.04 RECORD DRAWINGS

- A. Maintain on a daily basis at the project site a complete set of record drawings reflecting an accurate dimensional record of all deviations between work shown on the drawing and that actually installed.
- B. Show any changes to specified equipment such as manufacturer, voltage, model number, capacity, etc. on record drawings.
- C. Provide two reproducible copies of the record drawing to the owner.

3.05 COMMISSIONING

- A. At the conclusion of the installation the contractor shall convene a pre-commissioning meeting to review the implementation of the commissioning process.

- B. Contractor shall verify that all building services, gas, electric, water, sewer, and information technologies are functional prior to beginning commissioning.
- C. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the owner will exercise right to correct the Work under terms of the Construction of the Contract.
- D. The commissioning team shall comprise the general, mechanical, electrical, controls and plumbing contractors, the project manager, test and balance company, and the mechanical engineer. Provide sample forms for review to the mechanical engineer prior at pre-commissioning meeting.
- E. The commissioning process shall be including function testing all equipment, controls, natural gas, and electrical systems. All testing shall be documented in an item by item report with dates of test, test parameters and results.
- F. Provide commissioning report to project manager within two weeks of completion.

END OF SECTION

This Page Blank

Section 23 0529
Hangers and Supports for HVAC Equipment

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
 - 1. Metal framing systems.
 - 2. Fastener systems.
 - 3. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 PERFORMANCE REQUIREMENTS

- A. Design seismic-restraint hangers and supports for piping and equipment per Unistrut OSHPD Pre-Approved OPM-0295-13.

1.05 SUBMITTALS

- A. Product Data: For the following:
 - 1. Strut and fittings.
 - 2. Fasteners.

1.06 QUALITY ASSURANCE

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

-
1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.2, "Structural Welding Code--Aluminum."
 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. B-Line Systems, Inc.; A Division of Cooper Industries.
 2. Unistrut Corp.; Atkore International, Ltd.
- C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Refrigerant Pipe Support Options:
 1. EPDM clamp insert at all pipe clamps at refrigerant piping.
 2. Strut Mount Insulation Couplings (Hydra Zorb Kilo Shure 7 Series or similar)

2.03 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. B-Line Systems, Inc.; a division of Cooper Industries.

-
- 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. Unistrut Corp.; Atkore International, Ltd.
- C. Coatings: At Interior - Manufacturer's standard finish – At exterior - Hot dipped galvanized.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type interior/exterior steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Install per ICC listing.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Hilti, Inc.
- C. Wood Screws for secure pipe and duct supports to wood structure
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Simpson SDS Screws
 - b. or equal with self drilling feature and ICC report
- D. Sheet Metal Screws
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. TEK Screws
 - b. or equal with self drilling feature and ICC report

2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel shall be hot dipped aluminized.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Use hangers and supports with hot dipped galvanized, at exterior locations.
- B. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
 - 1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- C. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:
 - 1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- D. Use mechanical-expansion anchors where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- C. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- E. 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.
- F. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. All pipes and ducts shall be braced per Unistrut OSHPD Pre-Approved OPM-0295-13.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Provide lateral bracing, to prevent swaying, for equipment supports.
- C. Anchor all equipment to resist seismic motion.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 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 welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. If material is galvanized spray with cold galvanizing.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply three coats of galvanizing-repair paint to comply with ASTM A 780.

-
- D. Paint to match adjacent surface. Verify color with school district. See painting specifications.

END OF SECTION

Section 23 0593
Testing, Adjusting, and Balancing for HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.03 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, Adjusting, and Balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.04 SUBMITTALS

- A. Certified TAB reports.
- B. Sample report forms.
- C. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.05 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB, or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.
- B. TAB Conference: Meet with Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.06 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures where applicable.
- B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems – Testing, Adjusting, and Balancing" and in this Section.
 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Adjust using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

3. Manufacturer's name, model number, and serial number.
4. Motor horsepower rating.
5. Motor rpm.
6. Efficiency rating.
7. Nameplate and measured voltage, each phase.
8. Nameplate and measured amperage, each phase.
9. Starter thermal-protection-element rating.

- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 - 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.08 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.09 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.

2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 10. Report date.
 11. Signature of TAB supervisor who certifies the report.
 12. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 13. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 14. Nomenclature sheets for each item of equipment.
 15. Data for terminal units, including manufacturer's name, type, size, and fittings.
 16. Notes to explain why certain final data in the body of reports vary from indicated values.
 17. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.

- c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
2. Motor Data:
- a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
- a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.

- j. Circuiting arrangement.
- 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.
 - o. Inlet steam pressure in psig.
- G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
 - 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - 2. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.

- g. Air static-pressure differential in inches wg.
- h. Low-fire fuel input in Btu/h.
- i. High-fire fuel input in Btu/h.
- j. Manifold pressure in psig.
- k. High-temperature-limit setting in deg F.
- l. Operating set point in Btu/h.
- m. Motor voltage at each connection.
- n. Motor amperage for each phase.
- o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System and air-handling-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.

- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft..
- g. Indicated air flow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual air flow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary air flow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final air flow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

- a. System and air-handling-unit identification.
- b. Location and zone.
- c. Room or riser served.
- d. Coil make and size.
- e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Entering-water temperature in deg F.
- c. Leaving-water temperature in deg F.
- d. Water pressure drop in feet of head or psig.

- e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- M. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make any adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION

**SECTION 23 0700
HVAC INSULATION**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Sealants.
 - 4. Field-applied jackets.
 - 5. Tapes.
 - 6. Securements.
- B. Related Sections:
 - 1. Division 22 Section "Plumbing Insulation."
 - 2. Division 23 Section "Metal Ducts" for duct liners.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
- C. Qualification Data: For qualified Installer.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- E. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 GLASS FIBER, FLEXIBLE

- A. Manufacturers:
 - 1. Johns Manville Microlite
 - 2. Knauf PermaWick
 - 3. Or equal.
- B. Insulation: ASTM C553 C612; flexible, noncombustible blanket.
 - 1. 'K' ('Ksi') value: ASTM C518, 0.29 at 75 degrees F (0.042 at 24 degrees C).
 - 2. Maximum service temperature: 250 degrees F (121 degrees C).
 - 3. Maximum moisture absorption: 0.20 percent by volume.
- C. Vapor Barrier Jacket
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film 0.0032 inch (0.081 mm) vinyl.
 - 2. Moisture vapor transmission: ASTM E96; 0.04 perm.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape
 - 1. Manufacturers:
 - a. Polyken Model 236.
 - b. Or equal.
- E. Tie Wire: Annealed steel, 16 gauge (1.5 mm).

2.02 GLASS FIBER DUCT LINER, FLEXIBLE

- A. Manufacturers:
 - 1. Certainteed Tough Guard R with ES.
 - 2. Or equal.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 2. Maximum service temperature: 250 degrees F (121 degrees C).
- C. Adhesive
1. Waterproof fire-retardant type
 - 2.. Manufacturers:
 - a. Kingco/Glenkote Seal-Flex Model 11-500.
 - b. Or equal.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

2.03 INSULATION MATERIALS – REFRIGERANT PIPING

- A. Flexible Elastomeric for refrigerant pipes: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Glue all joints with manufacturer sealant.
1. Products: Subject to compliance with requirements, include, but are not limited to, the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
 2. Pipe insulation must be installed strictly in accordance with insulation manufactures installation instructions. Insulation thickness shall be per the 2022 building energy efficiency standards, requirements for pipe insulation and table 120.3-a

2.04 FIELD-APPLIED JACKETS

Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

- B. Metal Jacket: Install at exterior locations.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Aluminum Jacketing with formed aluminum fittings.

2.05 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products; Bands.
- b. PABCO Metals Corporation; Bands.
- c. RPR Products, Inc.; Bands.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, ½ inch.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1). AGM Industries, Inc.; CWP-1.
 - 2). GEMCO; CD.
 - 3). Midwest Fasteners, Inc.; CD.
 - 4). Nelson Stud Welding; TPA, TPC, and TPS.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Keep insulation materials dry during application and finishing.
- F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- G. Install insulation with least number of joints practical.

3.04 INSTALLATION

- A. Install materials in accordance with Manufacturer's instructions.
- B. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor barrier jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 - 3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- E. Exposed Spiral Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 100 percent coverage.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
3. Seal and smooth joints.
4. Seal liner surface penetrations with adhesive.
5. Unless indicated otherwise on plans, duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for liner thickness.

3.05 TOLERANCE

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.06 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS	FINISH
	Inch (mm)	
Outside Air Intake Ducts	2" (76.2)	Alum. Foil
Supply Ducts	2" (76.2)	Alum. Foil
Return Ducts	2" (76.2)	Alum. Foil
LINER	THICKNESS	FINISH
	Inch (mm)	
Supply and Return Plenums	1" (76.2)	

END OF SECTION

This Page Blank

**Section 23 0802
Air Cleaning**

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Disposable panel filters.

1.02 REFERENCES

- A. ANSI/UL 586 - Test Performance of High Efficiency Particulate, Air Filter Units.
- B. ANSI/UL 900 - Test Performance of Air Filter Units.
- C. ASHRAE 52 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

1.03 QUALITY ASSURANCE

- A. Filter media shall be ANSI/UL 900 listed, Class 1 or Class 2, as approved by local authorities.
- B. Provide all filters as product of one Manufacturer.
- C. Assemble filter components to form filter banks from products of one Manufacturer.

1.04 SUBMITTALS

- A. Submit product data under provisions of the general conditions on filter media, filter performance data, filter assembly and filter frames.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of the General Conditions.
- B. Include instructions for operation, changing, and periodic cleaning.

1.06 EXTRA STOCK

- A. Provide one set of each size disposable panel filters under provisions of Section the General Conditions for every unit installed.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of General Conditions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. FARR 2" MERV 13 FILTERS

2.02 DISPOSABLE, EXTENDED AREA PANEL FILTERS

- A. Media: Pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to welded wire grid; enclosed in cardboard frame.
- B. Rating: ASHRAE 52; 20 percent dust spot efficiency, 85 percent weight arrestance; 500 FPM (2.54 m/sec) face velocity, 0.30 inch WG (75 Pa) initial resistance, 1.0 inch WG (250 Pa) recommended final resistance.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install air cleaning devices in accordance with Manufacturer's instructions.
- B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Do not operate fan system until filters (temporary or permanent) are in place. One month after completion of construction replace all filters.
- D. Provide one spare set of filters to owner for every unit.

END OF SECTION

Section 23 0922
Climate Management Control for HVAC

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. Consult the above for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 01.

1.02 CONTROL SYSTEM DESCRIPTIONS

- A. The Building Automation System (BAS) shall be as indicated on the drawings and described in these specifications. System shall include a network of commercial Internet-programmable thermostats, their accessories, and any other networked devices required for complete climate management. Devices shall communicate across a wireless network using IEEE 802.15.4 technical standards. Wireless communication shall be of an automated mesh communication type, which self-establishes network addresses, communication routes, and all other setup requirements to establish connection across the entire campus. A single Ethernet-connected Gateway shall be able to connect the wireless mesh network to the Internet, allowing for climate management through a cloud based web-application. This network design is to be used to isolate the BAS from the owner's private Ethernet network (LAN) and/or WiFi networks. IEEE 802.11 or any other wireless standard of communication or a wired network communication protocol between devices is not acceptable by these BAS specifications. The Gateway is to connect to a single outbound Ethernet connection on the owner's wide area network (WAN) over a TCP/IP connection. The owner's firewall shall not require any inbound port assignments for the Gateway to connect to the cloud servers. The Gateway shall not require a Public IP and it shall not run any standard available operating systems, such as Windows or Linux.
- B. Access and control of BAS shall be through a web-based graphical management platform. The BAS platform shall sit on a cloud server and be accessible on both local personal computers and remotely by use of a web-browser that supports HTML5 or later.
- C. No on-site servers are to be installed or used for the BAS. No licensing fees or future licensing fees shall be required as part of the BAS. These specifications and guidelines are to create a cohesive and secure network that provides full management over the facility's climate through the cloud BAS.

- D. The BAS shall accommodate an unlimited simultaneous multiple-user operation. Access to the BAS shall be limiting based on security permissions of each operator's role managed by owner site Administrators.

1.03 APPROVED BUILDING AUTOMATION SYSTEM MANUFACTURERS

- A. Pelican Wireless Systems

1.04 SUBMITTALS

- A. Shop drawings and manufacturer's standard specification data sheets on all hardware shall be provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.
- B. All submittals shall be bound, in a three-ring binder, or provided digitally on a USB stick with a table of contents and related section tabs. Five (5) copies shall be submitted to the Architect or Engineer for distribution and review.
- C. Shop drawings shall include basic floor plans depicting locations of all equipment and wiring (installed by others) to be controlled by system and locations of thermostats, gateways, and other equipment provided under this section. Drawings shall also show location of electrical power, low voltage wiring and data ports, provided by others, required for proper installation of systems of this section.
- D. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all documents for accuracy.
- E. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

1.05 SYSTEM STARTUP & COMMISSIONING

- A. Each BAS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Documentation shall be provided to the owner that proves installation and testing has been completed and points out any mechanical issues found which are not related to the installation of the BAS. Successful completion of the system tests shall constitute the beginning of the warranty period.

- B. The BAS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall have a trained technician available on request during the balancing of the systems. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to the BAS.
- C. Upon completion of installation, submit three (3) copies of record documents. The documents shall be submitted for approval prior to final completion and include:
 - 1. Testing and Commissioning Reports and Checklists signed off by trained field commissioning personnel.
 - 2. Name, address and telephone number of Contractor personnel managing and installing equipment, along with service personnel responsible for supporting the ongoing warranty and services of the control system.
 - 3. Procedures for operating the BAS, including logging on/off, alarm management, reading reports, trends, modification of setpoints, scheduling, and other interactive system requirements.
 - 4. Provide information on how to receive support from Pelican Wireless Systems and communicate that they are a direct supporting resource. Contact information for Technical Support from Pelican Wireless Systems is to be provided.

1.06 CODES AND STANDARDS

- A. Codes and Standards. Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section:
 - 1. California 2022 Title 24 Compliant
 - 2. California Energy Commission Occupant Control Smart Thermostat (OCST) certified
 - 3. OpenADR 2.0 certified

1.07 TRAINING

- A. The BAS Contractor shall provide training for two (2) owner representatives and/or maintenance personnel. The BAS Contractor shall provide on-site training to the District's representative(s) and maintenance personnel per the following description:
- B. On-site training shall consist of a minimum of (1) hours, as indicated above of hands-on instruction geared at the operation and maintenance of the _____ systems. The curriculum shall include:
 - 1. System Overview
 - 2. System Application and Operation
 - 3. System Access
 - 4. Application Features Overview

5. Changing Set Points and other attributes
6. Scheduling
7. Editing configurable variables
8. Graphics
9. Viewing Historical Reports
10. Operational sequences including start-up, shutdown, adjusting and balancing
11. Equipment maintenance

1.08 OPERATING AND MAINTENANCE MANUALS

- A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire BAS.
- B. Following project completion and testing, the BAS contractor will submit as-built documentation reflecting the exact installation of the system.

1.09 WARRANTY

- A. The BAS contractor shall warrant the system for 12 months after system acceptance and beneficial use by the owner. During the warranty period, the BAS contractor shall be responsible for all necessary revisions as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification. BAS equipment shall include a limited-warranty by the manufacturer for a period of five (5) years from the time of system acceptance.
- B. Limited-warranty by manufacturer is limited to replacement of defective products.

1.10 WORK BY OTHERS

- A. The BAS Contractor shall coordinate with other contractors prior to performing the work on this project and cooperate as necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work prior to fabrication and installation. The owner's representative shall be immediately notified if an area of conflict occurs between trades prior to fabrication and installation. BAS Contractor shall provide field supervision to the Mechanical Contractor for pre-installation of control components.
- B. Low-voltage thermostat wiring between equipment and thermostat locations shall be furnished and installed by others. Unless otherwise noted all new low-voltage wiring shall be multiple conductor thermostat wiring (wire count as indicated in Thermostat Manufacturer's Installation Instructions) installed per owner's specifications. (Wiring in existing installations shall be minimum three (3) conductor/18-gauge wires per BAS manufacturer's standard specifications,

multiple conductor/18-gauge thermostat wiring preferred - see Installation Instructions for specific conductor counts depending on heating and cooling modes of existing equipment.)

- C. Related work provided by others:
 - 1. 110V outlets shall be provided within five (5) feet of each Gateway or Wireless Repeater location.
 - 2. One (1) Ethernet data port shall be provided within ten (10) feet of each Gateway location.
- D. Equipment start-up and servicing.

1.11 SCOPE OF WORK

- A. Except where otherwise noted, the system shall consist of a network of commercial Internet-programmable thermostats, their accessories, and any other networked climate management device(s) required to fill the intent of the specification, sequence of operations, and provide for a complete and operable system.
- B. The BAS contractor shall review and study existing building/site conditions where applicable and all new construction drawings for the project including HVAC drawings and the entire project specifications to familiarize themselves with the equipment and system operation prior to bidding and submittal of a bid/price and notify the owner immediately of any conflicts between the project and the scope of work of this section, including work to be completed by others.
- C. All equipment and installation of control devices associated with the equipment listed below shall be provided under this BAS contractor.
- D. When the BAS is fully installed and operational, the BAS contractor will make themselves available to meet with the designated representatives of the owner to review the as-installed condition of the system. At that time, the BAS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.
- E. The BAS contractor shall furnish and install a complete BAS control system, including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification.
- F. Provide and install BAS controls for the HVAC Equipment as noted on the drawings.
- G. Provide technical support necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor, and the owner's team.
- H. Shall provide one training session in the operation of the system for owner's personnel.

- I. All work performed under this section of the specifications will be in compliance with all codes and regulations as mandated by the authority having jurisdiction.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless otherwise noted, all product shall be of a single manufacturer. The standard of design and quality shall be products as manufactured by Pelican Wireless Systems.

2.02 COMMUNICATION

- A. This project shall be comprised of a network of devices that use an IEEE 802.15.4 self-creating and self-healing wireless mesh communication network to reach an Ethernet Gateway.
- B. The Gateway shall communicate to cloud servers via a single Ethernet connection at the owner's wide area network (WAN) over a TCP/IP connection. The facility's firewall shall not require any inbound port assignments for the Gateway to connect to the cloud servers. The Gateway shall not require a Public IP.
- C. No BACnet, modBus, LON, or any other device-to-device wired communication protocol shall be used in the communication network.

2.03 OPERATOR INTERFACE

- A. The BAS shall be controlled, managed, and configured using a Web-App on any personal computer, smartphone, and/or tablet that runs a browser with HTML5 or newer.
- B. The Web-App platform shall run on cloud servers which allow for virtual access. Platform shall not run on a local on-site server.
- C. The Web-App shall support at a minimum, the following functions:
 - 1. Personal user log-on identifications (email addresses) and unique passwords shall be required.
 - 2. Custom HTML programming shall not be required to display any graphics, data, or build the Web-App. There shall be no development cost, commissioning costs, or software upgrade cost required to obtain and use the Web-App.
 - 3. Storage of historical data shall reside on the cloud server and shall not sit within the client's computer, internal network, or other devices. A BAS, which requires on-site data storage, is not acceptable.
 - 4. System shall allow for administrator and user defined access privileges.
 - 5. A Push/Pull OpenAPI interface with XML data output shall be available.

6. Servers shall not run a Windows operating system.

D. Control and Override

1. The BAS shall provide view, override, and edit of the status of any object and property in the system. The status of the device shall be defined graphically and shall not require any custom programs or programming.
2. Temporary Overrides. The BAS shall be able to provide temporary override (wherever an override is allowed) and automatically remove the override after a specified period of time.
3. Any override and edit of a object virtually or at the device, if allowable, shall be historically tracked.

E. Scheduling

1. The BAS shall provide users with scheduling of application devices through a graphical interface. Scheduling shall include, but is not limited to:
 - i. Occupied/Unoccupied Schedules. Shall allow 12 scheduled set-time changes in a single day, be configurable for Daily, Weekly, and Weekday/Weekend layouts, and shall be able to be unique to individual devices or easily shared between multiple devices, where applicable.
 - ii. Event Schedules. Shall allow for advanced one-time or repeating event type schedules. Event schedules shall override Occupied/Unoccupied Schedules. After the Event schedule ends, the device shall revert back to the Occupied/Unoccupied Schedule automatically.
 - iii. Vacation Schedules. A 360-day Calendar shall provide override of schedules during vacation days. Thermostats shall be able to automatically or be manually switched to follow Vacation Schedules instead of Occupied/Unoccupied Schedules.

F. Alarm Notification

1. Alarm Notification(s) shall be generated if there are failures detected by devices part of the BAS. These failures shall be, but are not limited to: temperature deviations, temperatures missing targets, temperatures too high or too low, failures of equipment, etc. Alarm Notification(s) shall be posted on the BAS and shall be able to be sent either via email or text message to an unlimited number of users.

G. Reports and Logs

1. Data shall be logged and stored on cloud servers for all devices part of BAS in real-time. Every device real-time “state change”, when applicable, shall be stored and viewable for at least one week, with the option of up to two (2) years.
 - i. Each space temperature
 - ii. Each temperature set point(s)
 - iii. Each current call: heat, cool, number of stages, fan, economizer, etc.
 - iv. Each damper position
 - v. Each valve position

- vi. Each CO² change
- vii. Each CO² setting
- viii. Each current call for ventilation due to high CO²
- ix. Each Humidity change
- x. Each Humidity set point
- xi. Each current call for dehumidification or humidification.
- xii. Each Fan speed adjustment
- xiii. Supply duct static pressure
- xiv. Supply, Return, Outside air temperatures
2. Data shall be represented on historical graphs that allow for easy viewing of device state change at different times.
3. Excel outputs shall not be required to view data. Historical data shall be viewable through BAS.

2.04 APPLICATION-SPECIFIC CONTROLLERS

- A. Application Specific Controllers shall not require custom programming and shall control specific equipment through simple configuration settings done through the cloud-based BAS. All configuration changes shall automatically upload into the device once set on the BAS and shall be stored by the device's internal memory.
- B. Gateways are devices which connected to an Ethernet port and act as a bridge between the BAS cloud servers and the wireless mesh network.
 1. Shall be capable of providing Internet connection to up to 2,000 devices.
 2. Shall be capable of automatically addressing routing tables to all devices part of wireless mesh network and shall not require manual programming or addressing.
 3. Shall communicate to cloud servers over a TCP/IP outbound-only connection.
 4. Shall not require a Public IP address, custom VPNs, or any on-site servers.
 5. Shall communicate to other BAS devices over the dedicated and isolated 802.15.4 IEEE technical standard.
 6. Shall be secured using AES (Advanced Encryption Standards).
- C. Internet-Enabled Thermostats are controllers which detect a space/zone temperature and operate equipment or dampers which supply heating, cooling, ventilation, or a combination of the three mechanical states, to their space/zone. Examples are thermostats for VAV, VVT, Fan-Powered Boxes, Fan Coil, Blower Coils, Unit Ventilators, Heat Pumps, Water Source Heat Pumps, and Conventional DX and/or Gas heat equipment.
 1. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: two stages of fan, three stages of cooling, two stages of heating, one stage of auxiliary heat (heat pumps), floating point zone dampers, two position zone dampers, floating point zone reheat valves, and two position zone reheat valves.

2. Shall include a removable wiring terminal module that allows for thermostat installation even in situations where there are only three wires between equipment and where the thermostat is to be installed.
 3. Shall be available with the following internal sensors: temperature only, temperature and humidity, temperature, humidity, and CO², and temperature and CO². All sensors required by the specifications are to be internal to the thermostat and not require two devices on the wall.
 4. Shall be able to accept expansion accessories that allow for more advanced control sequences, and additional temperature detection. Examples are economizer controllers, outside air ventilation control, supply air temperature detection, unit ventilator face/bypass control, and modulating control. All expansion accessories shall be Internet enabled and accessible through EMS.
 5. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 6. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
 7. Shall automatically push, in real-time, to the BAS all “state changes” so as to be viewable historically and in real-time from BAS. Examples are changes in equipment operation (heat, cool, fan), number of stages active, the temperatures in the space, damper position, valve position, temperature set-points, etc.
 8. Shall be able to lock-out heat pump compressor(s) based on outside air temperature.
 9. Shall provide set-point (heat & cool) temperature limitations through BAS.
 10. Shall provide full local keypad lock-out from BAS.
 11. Shall meet California 2022 Title 24 code standards.
 12. Shall have a programmable three (3°F) degree heat/cool temperature range which auto-adjusts to a five (5°F) degree dead band.
 13. Shall have both a heat setpoint, cool setpoint, and auto-changeover.
 14. Shall have Optimum Start algorithms that will calculate start times based on at least seven (7) days of previous run-time temperature and rate-of-change historical data for its space. Optimum Start algorithm shall recalculate each optimized schedule time before each optimized schedule.
 15. Shall be able to be manually overridden through BAS.
 16. Shall be configured through BAS.
- D. Wired Temperature Inputs are to be available to provide external temperature detection for specific BAS devices. Examples are to provide supply air temperature, water temperature, refrigeration temperature, outside air temperature, etc. to a thermostat or other device.
1. Shall accept 10K type II thermistors.
 2. Shall push to the BAS real-time temperature changes so as to be viewable historically and in real-time from the BAS.
 3. Shall accept a thermistor at a maximum of up to 100 feet from input terminal.
 4. Shall be configured through the BAS.

- E. Internet-Enabled Economizer Controller are controllers that modulate an outside air damper to provide ventilation and economization to a single zone.
1. Shall only require a dry-bulb outside air temperature sensor and dry-bulb supply air temperature sensor. No dry-bulb return air temperature sensor or dry-bulb mixing box temperature sensor shall be required to meet full economizer functionality to at a minimum California 2022 Title 24 standards.
 2. Shall communicate with thermostat to determine space temperature and space temperature setpoint in order to decide when economization can be used.
 3. Shall continue to economize as its only source of cooling as long as the outside air temperature is able to keep the space temperature within 1°F of the cool temperature setpoint.
 4. Shall be able to enable mechanical cooling at the same time as economization.
 5. Shall be able to prevent the supply air temperature from dropping below a minimum temperature.
 6. Shall provide enthalpy by use of pulling humidity and barometric pressure information from the Internet based on the zipcode of installation location. Enthalpy shall not require any additional probes other than the dry-bulb probe and shall be free to enable.
 7. If connected to a CO² thermostat, shall be able to provide demand ventilation control of outside air damper.
 8. Shall have a minimum ventilation damper position and a maximum ventilation damper position.
 9. Shall be able to be scheduled to not open the outside air damper for ventilation during unoccupied hours.
 10. Shall be able to control a Variable Frequency Drive (VFD) with up to five (5) fan speed inputs. Example of fan speed changes are during ventilation, stage one cooling, stage two cooling, stage one heating, stage two heating.
 11. Shall modulate an outside air damper by use of a 0-10VDC signal.
 12. Shall accept a 0-10VDC signal feedback input from the outside air damper actuator to confirm outside air damper is working correctly.
 13. Shall meet all California 2022 Title 24 codes, including Fault Detection and Diagnostic requirements.
 14. Shall send Fault Detection and Diagnostic information to the BAS.
 15. Shall accept a minimum of three (3) 10K type II thermistors.
 16. Shall be able to modulate a 0-10VDC hot water, steam, or electric SCR for heating and outside air tempering.
 17. Shall be able to modulate a 0-10VDC chilled water or modulating DX for cooling and outside air tempering.
 18. Shall be able to control a face/bypass damper.
 19. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air

- temperature, hot water valve position, face/bypass damper position, variable speed fan setting, etc.
20. Shall be able to be manually overridden through the BAS.
 21. Shall be configured through the BAS.
- F. Internet-Enabled Power Relay Module are controllers which have dry-contact relays able to start/stop different electrical equipment. Examples are exhaust fans, lights, pumps, valves, boilers, chillers, etc.
1. Shall have relays with a max rating of 120 VAC @ 15 AMPs or 240/277 VAC @ 10 AMPs.
 2. Shall have a low-voltage terminal for momentary contact override inputs. Override time shall be configurable for a specific amount of minutes through a configuration from the BAS.
 3. Shall be able to provide Lead/Lag sequencing between relays.
 4. Shall be able to accept an external dry-contact input used to verify flow if being used as a pump controller. If being used as a lead/lag pump controller, shall be able to alarm the BAS if flow is not detected when Pump A is enabled and start Pump B as a stand-by pump.
 5. Shall communicate with the wireless mesh network through an external wireless antenna that runs on the 802.15.4 technical standards. Antenna shall be able to communicate with Power Relay Module over three (3) 18-gauge wires up to 500 feet between device terminal inputs.
 6. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
 7. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in relay positions On or Off.
 8. Shall be able to be manually overridden through the BAS.
 9. Shall be configured through the BAS.
- G. Zone Controllers are controllers which operate equipment which supply heating, cooling and ventilation, or a combination of these mechanical states to multiple zones.
1. Shall communicate with the wireless mesh network through a removable wireless antenna that runs on the 802.15.4 technical standards.
 2. Remote mountable antenna shall be able to communicate to Zone Controller over three (3) 18-gauge wires up to 500 feet between devices terminal inputs.
 3. Communication from the Zone Controller to all zone/space Thermostats shall be over the wireless mesh network.
 4. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: multiple stages of fan, multiple stages of cooling, and multiple stages of heating.

5. Shall be capable of providing 0-10VDC outputs which can be configured to provide control of the following: variable speed fan (VFD), modulating outside air damper, modulating heating valve.
6. Shall have integrated outside air damper control logic and not require a third-party or additional controllers to provide economization and ventilation control.
7. Shall directly accept a supply duct static pressure probe. Shall have an integrated short-term and long-term learning PID loop algorithm for maintaining target supply static configurations. PID loop shall not require any type of cost for programming and is to be factory loaded into controller.
8. Shall only require dry-bulb outside, return, and supply air temperature sensors.
9. If communicating to CO² thermostat(s), shall be able to provide demand ventilation control of outside air damper.
10. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air temperature, the outside air temperature, hot water valve position, supply duct static reading, variable speed fan setting, etc.
11. Shall be able to be manually overridden through the BAS.
12. Shall be configured through the BAS.

H. Make-up Air Controllers which operate equipment supplying ventilation to the building.

1. Shall communicate with the wireless mesh network through a removable wireless antenna that runs on the 802.15.4 technical standards.
2. Remote mountable antenna shall be able to communicate to Controller over three (3) 18-gauge wires up to 500 feet between devices terminal inputs.
3. Communication from the Controller to zone/space Thermostat(s) shall be over the wireless mesh network.
4. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: multiple stages of fan, multiple stages of cooling, and multiple stages of heating.
5. Shall be capable of providing 0-10VDC outputs which can be configured to provide control of the following: modulating variable speed fan (VFD), modulating outside air damper, modulating heating, modulating cooling.
6. Shall be able to modulate a VFD to maintain a targeted building static pressure.
7. Shall be able to modulate a 0-10VDC hot water, steam, or electric SCR for heating and outside air tempering.
8. Shall be able to modulate a 0-10VDC chilled water or modulating DX for cooling and outside air tempering.
9. Shall have integrated outside air damper control logic.
10. Shall directly accept a building pressure probe. Shall have an integrated short-term and long-term learning PID loop algorithm for maintaining target building pressure. PID loop

shall not require any type of cost for programming, is to be factory loaded into controller, and updatable virtually through EMS.

11. Shall only require dry-bulb outside and supply air temperature sensors.
 12. If communicating to CO² thermostat(s), shall be able to provide demand ventilation control of outside air damper.
 13. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air temperature, the outside air temperature, hot water valve position, supply duct static reading, variable speed fan setting, etc.
 14. Shall be scheduled On or Off through the BAS.
 15. Shall be able to be manually overridden through the BAS.
 16. Shall be configured through the BAS.
- I. Wireless Proximity Sensors are thermostat accessories which are able to detect when a door or window is opened or closed, or be able to accept a dry-contact input from an occupancy sensor.
1. Shall be able to communicate to a single Internet-Programmable Thermostat over wireless mesh network.
 2. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 3. Shall run on two AA batteries and not require any unique type of battery to operate.
 4. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are if the door is open, if the space is unoccupied, if a window is open.
 5. Shall be configured through the BAS.
- J. Remote Wireless Sensors are thermostat accessories which are used to either average temperatures between the sensors location and a master thermostat or to relocate the sensing location of the master thermostat without having to run new wire.
1. Shall be able to communicate to a single Internet-Programmable Thermostat over wireless mesh network.
 2. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 3. Shall run on two AA batteries and not require any unique type of battery to operate.
 4. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan), number of stages active, the temperatures in the space, temperature set-points, etc.
 5. Shall be configured through the BAS.

- K. Wireless Repeaters are devices which extend the 802.15.4 wireless mesh network across large expanses or where BAS devices are unable to repeat the wireless mesh network on their own. Examples are when bridging the wireless mesh network from one building to another.
 - 1. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 - 2. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
 - 3. Shall not require an Ethernet connection or any TCP/IP connection.
 - 4. Shall only require a single 120V outlet for power.
 - 5. Indicate location of repeaters on As-Built drawings.

- L. Configuration of Devices and System
 - 1. To meet the sequence of operation for each controller, the controller shall be configured through the BAS by the installing contractor. No custom programming or downloading by use of a service tool shall be required.
 - 2. Stand-Alone Operation: Each piece of equipment specified shall provide stand-alone operation. BAS devices shall not require web connection or communication to the BAS to run under normal operations.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The BAS manufacturer shall be available to provide assistance to BAS Contractor in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.02 PROTECTION

- A. The BAS installing contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.
- B. The BAS installing contractor shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is

not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

- C. Installation of BAS shall be performed by an approved Contractor. Approved contractor is one whom either has installed the BAS before or has been approved by the BAS manufacturer. The Contractor shall certify all work as proper and complete. Under no circumstance shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor unless that subcontractor meets the BAS approved Contractor requirements as stated above.
- D. Demolition. Remove controls which do not remain as part of the BAS. The owner will inform the Contractor of any equipment which is to be removed that will remain the property of the owner. All other equipment which is remove will be disposed of by the Contractor.
- E. Access to Site. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the owner or an owner-approved representative.
- F. Code Compliance. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations.
- G. Clean Up. During installation, contractor shall maintain a clean environment. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.03 TEST AND BALANCE

- A. Testing of controls shall be performed by installing contractor. All equipment and their components being controlled shall be tested, including, but not limited too: heating enables and a proper supply air temperature from the AHU, RTU, and into the zone (if there is a zone box) is recorded, cooling enables and a proper supply air temperature from the AHU, RTU, and into the zone (if there is a zone box) is recorded, fan enables and the proper fan speed is set when specified (when using a multiple speed fan, VFD, or ECM motor), and that the outside air damper fully opens and closes when commanded. Any devices that are enabled and disabled shall properly respond to the BAS control signals.
- B. All control configurations shall be set to meet specifications. All temperatures and other sensors shall be determined accurate and configured for the type of temperature being detected.
- C. All mechanical systems controlled by BAS shall be properly balanced to the right CFMs to meet required codes and specifications.

3.04 WIRING, CONDUIT, AND CABLE

- A. All control wires between mechanical equipment and BAS devices are to be furnished and installed by others, unless BAS contractor is responsible for this part of the installation. The BAS contractor shall not begin work on this contract until all wiring is installed to the satisfaction of the BAS contractor.
- B. It is not an excuse to have not referenced the manufacturer's installation documentation or to have contacted the BAS manufacturer if wire installation is not understood and done incorrectly by the installing Contractor.

3.05 HARDWARE INSTALLATION

- A. Installation Practices for Devices. All devices are to be mounted level/plumb and per the manufacturer's installation documentation.
- B. It is not an excuse to have not referenced the manufacturer's installation documentation or to have contacted the BAS manufacturer if hardware installation not understood and done incorrectly by the installing Contractor.
- C. Identification.
 - 1. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
 - 2. All field enclosures, other than controllers, shall be identified with a nameplate. The lettering shall be in white against a black or blue background.
 - 3. Junction box covers will be marked to indicate that they are a part of the BAS.
 - 4. All field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
 - 5. All field devices inside FIP's shall be labeled.
- D. Existing Controls. Existing controls are not to be reused. All BAS devices will be new.
- E. Control System Switch-Over. The installing contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on-site so that the entire switch-over can be accomplished in a reasonable time frame.
- F. Location.
 - 1. The location of sensors is as indicated in the mechanical and architectural drawings.
 - 2. Space temperature, humidity, and CO² sensors will be mounted away from machinery generating heat, direct light, and/or diffuser air streams.

3. If external temperature sensors are installed, sensors will be mounted away from machinery generating heat, direct light, and/or diffuser air streams.
4. If outdoor air temperature sensors are installed, sensors are to be installed such that the effects of heat radiated from the building or sunlight is minimized.

3.06 SYSTEM CONFIGURATION

- A. General. The installing contractor shall provide all labor necessary to install, initialize, start-up and troubleshoot all system hardware and configurations described in this section. This includes any requirements necessary to access the web application on third-party devices.
- B. Installing contractor shall work with owner's representative to determine configuration parameters including but not limited to hours of operation, set points, system variables, naming of devices, and site naming. Naming of devices and the site shall be performed by the installing contractor. Naming convention of space thermostats shall be space served. Naming convention of zone controllers shall be the equipment serial number. All naming shall be provided by or agreed upon with the owner.

3.07 SYSTEM COMMISSIONING AND SYSTEM STARTUP

- A. Each BAS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Documentation shall be provided to the owner that proves installation and testing has been completed and points out any mechanical issues found that are not related to the installation of the BAS. Successful completion of the system tests shall constitute the beginning of the warranty period.
- B. The BAS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall have a trained technician available on request during the balancing of the systems. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to BAS.
- C. Upon completion of installation, submit three (3) copies of record documents. The documents shall be submitted for approval prior to final completion and include:
 1. Testing and Commissioning Reports and Checklists signed off by trained field commissioning personnel.
 2. Name, address and telephone number of Contractor personnel managing and installing equipment, along with service personnel responsible for supporting the ongoing warranty and services of the control system.

3. Procedures for operating the BAS including logging on/off, alarm management, reading reports, trends, modification of setpoints, scheduling, and other interactive system requirements.
4. Provide information on how to receive support from Pelican Wireless Systems and demonstrate that they are a direct supporting resource. Contact information for Technical Support from Pelican Wireless Systems is to be provided.

END OF SECTION

**Section 23 2300
Refrigerant Piping**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Check valves.
- G. Pressure relief valves.
- H. Filter-driers.
- I. Solenoid valves.
- J. Expansion valves.

1.02 RELATED SECTIONS

- A. Section 23 0700 - HVAC Insulation.

1.03 REFERENCES

- A. ARI 710 - Liquid Line Dryers.
- B. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers
- C. ARI 750 - Thermostatic Refrigerant Expansion Valves.
- D. ARI 760 - Solenoid Valves for Use With Volatile Refrigerants.
- E. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- F. ASHRAE 34 - Number Designation of Refrigerants.
- G. ASME - Boiler and Pressure Vessel Codes, SEC 9 Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
- H. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- I. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes.

- J. ASME B16.50 – Wrought Copper and Copper Alloy Braze-Joint Pressure Fitting
- K. ASME B31.5 - Refrigeration Piping.
- L. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- M. AWS A5.8 - Brazing Filler Metal.

1.04 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Valves
 - 1. Use factory-supplied service valves on condensing units.
- C. Replaceable Cartridge Filter-Driers:
- D. Solenoid Valves:
 - 1. Use in liquid line of single evaporator systems.

1.05 SUBMITTALS

- A. Submit under provisions of the general requirements.
- B. Shop Drawings: Provide shop drawings indicating manufacturer approved refrigerant piping, including equipment, critical dimensions, and sizes.
- C. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.
- D. Manufacturer's Installation Instructions: Indicate sizes, support, connection requirements, and isolation for servicing.
- E. Submit welders certification of compliance.

1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of the general requirements.
- B. Record exact locations of equipment and refrigeration accessories on record drawings.

1.07 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of the general requirements.
- B. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.08 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME SEC 9.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of the general requirements.
- B. Deliver and store piping and specialties in shipping containers with labeling in place.
- C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- D. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

1.10 WARRANTY

- A. Provide one year warranty under provisions of the general requirements.

PART 2 PRODUCTS

2.01 PIPING

- A. Copper Tubing: ASTM B280, Type ACR annealed.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F (640 to 805 degrees C).
- B. Pipe Supports and Anchors:
 - 1. Conform to Section 23 0529

2.02 REFRIGERANT

- A. Refrigerant: ASHRAE 34
 - 1. R-410A.

2.03 REFRIGERANT PIPING

- A. Insulate with closed cell neoprene insulation. Install 3/16" corrugated 0.016 aluminum jacketing with aluminum formed fittings at exterior.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Arrange piping to return oil to compressor.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Flood piping system with nitrogen when brazing.
- I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- J. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to the general requirements.
- K. Insulate piping and install aluminum jacket at exterior locations.
- L. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- M. Provide replaceable cartridge filter-driers.
- N. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- O. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- P. Fully charge completed system with refrigerant after testing.
- Q. Provide electrical connection to solenoid valves.

END OF SECTION

**Section 23 3000
Split System Heat Pumps**

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION – CAC SINGLE ZONE HEAT PUMP

The variable capacity, heat pump air conditioning system shall be a Samsung Electronics System. The systems shall be (cool/heat) split system heat pump.

The heat pump system shall consist of a single outdoor condensing unit, single indoor unit, and optional wired or wireless controller.

The condensing unit shall be a horizontal discharge, 208/230V, 1Ph, 60Hz. The evaporator shall be recessed, ceiling cassette type, wall-mounted (high-wall) type, console type, or concealed duct type.

1.02 QUALITY ASSURANCE

- A. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- D. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit. Additional refrigerant is required based on diameters and lengths of system liquid refrigerant lines and indoor equipment model and quantity.
- E. Service and installation manuals must be readily available on the manufacturer's website at all times without entering a username and password.

1.03 WARRANTY

1. LIMITED WARRANTY

If a part or compressor fails due to manufacture defect, SAMSUNG HVAC will replace defective part or compressor without charge for a period of 5 years for parts and 7 years for the compressor from the original date of installation. This limited warranty does not include labor. Extended warranties exist for certain products with registration where allowed for parts warranties up to 10 years and compressor warranties up to 10 years. Conditions apply. See manufacturer's warranty terms for full details and conditions available on their website.

1.04 OUTDOOR UNITS

1. CAC - AC0**BXADCH/AA (CXH**ADB) STANDARD HEAT PUMP CONDENSING UNITS (208/230V, 1Ø)

A. General:

1. The CAC heat pump outdoor unit shall be compatible with WindFree™* 4-way cassette, WindFree™* Mini 4-way cassette, WindFree™* 1-way cassette, 360 Cassette, Duct S (HSP), Multi-position, Slim Duct (LSP), console, and high-wall units.
2. The heat pump outdoor unit shall be capable of guaranteed operation in cooling mode between 23°F ~ 120°F (-5°C to 49°C) outside ambient temperatures.
3. The heat pump outdoor unit shall be capable of guaranteed operation in cooling mode below 23°F (-5°C) down to 0°F (-18°C) outside ambient temperature with the addition of factory provided front and rear wind baffles (accessory).
4. AC030BXADCH/AA, AC036BXADCH/AA, AC042BXADCH/AA, and AC048BXADCH/AA heat pump outdoor units shall be capable of guaranteed operation in heating mode between -4°F ~ 75°F (-20°C ~ 24°C) ambient temperatures.
5. The heat pump outdoor unit shall have an accumulator.
6. The heat pump outdoor unit shall auto-restart after power loss.
7. The heat pump outdoor unit shall have a high pressure safety switch, fuse, over-current protection, over-voltage protection, temperature limit protection logic, and compressor overload sensing.
8. The heat pump outdoor unit shall have snow accumulation prevention option setting to prevent snow drifting against an idle outdoor unit.
9. The heat pump outdoor unit shall have the capability to be configured as heating/cooling, cooling only, or heating only via outdoor unit option setting.
10. The system shall support limiting the maximum operating current from 50% - 100% via outdoor unit, wired controller or central controls (Maximum Current Control).

**The WindFree™ unit delivers an air current that is under 0.15 m/s while in WindFree™ mode. Air velocity that is below 0.15 m/s is considered “still air” as defined by ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).*

B. Refrigerant Piping:

1. Both refrigerant lines from the outdoor unit to indoor unit shall be insulated.

2. Installed refrigerant pipe length and vertical separation shall be within the published manufacturer's specifications.

C. Unit Cabinet:

1. The chassis shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

D. Fan:

1. The outdoor unit shall be furnished with axial fan(s) with BLDC motor(s).
2. All fan motors shall have inherent protection, thermal protection, and have permanently lubricated bearings, and be completely variable speed.
3. All fan motors shall be mounted for quiet operation.
4. All fans shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have horizontal discharge airflow.

E. Refrigerant:

1. R410A refrigerant shall be required for the heat pump system.
2. Additional refrigerant may be required. Amount is based on installed refrigerant pipe diameters and lengths.

F. Coil:

1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil shall be protected with an integral metal guard.
3. AC018BXADCH/AA, AC024BXADCH/AA, AC030BXADCH/AA, AC036BXADCH/AA, AC042BXADCH/AA, AC048BXADCH/AA - The Heat Pump condensing unit salt spray test method: ASTM B117 - the heat exchanger showed no unusual rust or corrosion development to 2,280 hours.

G. Compressor:

1. The compressor shall be an inverter driven, DC voltage, twin BLDC rotary compressor.
2. A crankcase heating device shall be factory mounted in/on the compressor.

3. The heat pump outdoor unit compressor shall have a soft-start function to reduce electricity demand during system start and to increase compressor reliability.
4. The compressor will be equipped with an internal thermal overload.
5. The compressor shall be mounted to avoid the transmission of vibration.

H. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 1 phase, and 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units and the outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, 16 AWG, two-core cable to provide total integration of the system.
5. The outdoor unit shall provide power to the indoor unit with 14 AWG X 3 power wire (2 X high voltage wires, 1 X ground). The power wire shall be run from the condensing unit to indoor unit.

PART 2 OUTDOOR UNIT ACCESSORIES

2.01 FRONT WIND BAFFLES FOR 1Ø CONDENSING UNITS (WBF-*)**

A. General

1. The outdoor unit(s) shall have a front wind baffle provided by the HVAC manufacturer.
2. The front wind baffle is designed to be placed on fan discharge side (front).
3. Only a front shield is required for applications where the outdoor unit is adjacent to a structure that would protect the intake side from prevailing wind. Applications without this protection would require a back shield (ex: roof top).
4. The wind baffle material shall be powder coated, galvanized steel.

2.02 BACK WIND BAFFLES FOR 1Ø CONDENSING UNITS (WBB-*)**

A. General

1. The outdoor unit(s) shall have a front wind baffle provided by the HVAC manufacturer.

2. The back wind baffle is designed to be placed on the coil intake side of the unit (back).
3. Note: This back shield is only required for applications where the outdoor unit is not adjacent to a structure that would protect the intake side from prevailing wind (ex: roof top).
4. The wind baffle material shall be powder coated, galvanized steel.

PART 3 INDOOR UNITS AND ACCESSORIES

3.01 AC*BNHDCH/AA (CNH**HDB) DUCT S (HSP) HIGH STATIC (CEILING-CONCEALED DUCTED) INDOOR UNIT FOR SINGLE ZONE SYSTEMS**

A. General:

The indoor unit shall be a high-performance, high static pressure capable, concealed ducted indoor fan coil that mounts above the ceiling with a fixed horizontal discharge supply and shall have a modulating expansion device (gear type). The high static pressure capable, concealed ducted indoor unit shall be compatible with 1:1 Standard (AC0**BXADCH/AA) and 1:1 Max Heat[®] low ambient heating (AC0**BXSCCH/AA) outdoor units. The high static pressure capable, concealed ducted indoor unit shall support individual control using SAMSUNG'S Control Network Solution (Control systems).

B. Indoor Unit.

1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function.
2. The indoor unit shall have an integral condensate pump as standard with 29" maximum lift from the bottom of the indoor unit.
3. The indoor unit shall have an integral condensate float switch to disable the unit in the event of condensate overflow.
4. The indoor unit shall allow service access from four sides (top, bottom, left, right).

C. Unit Cabinet:

1. The unit shall be space saving, ceiling-concealed, ducted.
2. The cabinet shall be constructed of insulated galvanized steel.

D. Fan:

1. The indoor unit fan shall be an assembly with two or three Sirocco fans, depending on model, direct driven by one (1) fan motor.
2. Standard external static pressure is 0.18" WC. Acceptable range: 0.1" – 0.6" WC for 9,000

– 12,000 btu/h indoor units.

3. Standard external static pressure is 0.18" WC. Acceptable range: 0.1" – 0.8" WC for 18,000 – 24,000 btu/h indoor units.
4. Standard external static pressure is 0.58" WC. Acceptable range: 0.1" – 0.8" WC for 30,000 btu/h indoor units.
5. Standard external static pressure is 0.58" WC. Acceptable range: 0.12" – 0.8" WC for 36,000 – 48,000 btu/h indoor units.
6. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
7. The indoor fan shall consist of three (3) speeds, High, Mid, and Low. Auto fan speed setting is available.
8. The indoor unit shall have a ducted air outlet system and ducted return air system.
9. The fan speed shall be adjustable by optional remote controller or manufacturer provided service software according to external static pressure.
10. The indoor unit shall have static pressure scanning for simple setup and optimized comfort settings for the occupant.
11. The indoor unit shall have smart-tuning function that can provide optimized comfort by allowing the occupant to offset the fan CFM curve with a compatible wired remote controller to increase or decrease airflow.

E. Filter:

1. Air filtration is field provided.
2. Optional return filter box (rear placement) is available.

F. Coil:

1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. Both refrigerant lines to the indoor units shall be insulated.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage tolerance is $\pm 10\%$.
3. The control circuit between the indoor unit and the outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two-core, 16 AWG cable to provide total integration of the system.
4. The indoor unit shall have a thermal fuse under the high-voltage terminal block to disable unit in the event of overheating due to electrical malfunction/poor connection.

H. Controls:

1. The indoor unit shall have the capability to be controlled via local wired controllers, wireless controllers, multi-unit Wi-Fi adapters, and central control options provided by the HVAC manufacturer.
2. This unit shall use controls provided by the HVAC manufacturer to perform functions necessary to operate the system. Please refer to the "Controls" section of this guide specification for details on controllers and other control options.
3. The indoor unit shall have a removable EEPROM on its PCB to store all unit data. All data on the indoor unit EEPROM shall be viewable from the manufacturer provided service software. The indoor unit main EEPROM shall be removable allowing replacement of indoor unit PCB without losing digital, field programmed data. The indoor unit removable EEPROM shall store the following unit data: unit model number, unit serial number, unit PCB firmware and MICOM version, and field programmed unit name/tag viewable on controls and service software.
4. The indoor unit shall feature a Dual Set point function that allows users to set separate heating and cooling set temperatures using supported local wired controller and central control options. Dual set temperature allows the user to specify a deadband where the unit will not heat or cool when room temperature is between the heating and cooling set temperatures. Dual set temperature can be used with heat pump or heat recovery systems.
5. The indoor unit shall feature an Emergency Temperature Output (ETO) function that will provide a signal when an indoor unit is in error status. When enabling ETO, a high room temperature threshold can also be programmed to provide a signal when the room temperature limit has been exceeded. The ETO signal can be used to activate backup systems, provide a simple signal to a building management system, or to provide a simple visual/audible notification locally (ex: LED, buzzer, etc.). A MIM-B14 External Contact Control interface module is required for each unit that will provide or receive an ETO signal.

PART 4 CONTROLS

4.01 THERMOSTAT ADAPTER FOR 24VAC THERMOSTAT CONNECTION (MIM-A60UN)

A. Function:

1. Controls adapter that will allow control of Samsung HVAC systems sold in North America with a standard 24VAC thermostat

B. Connection:

1. One adapter per indoor unit connected to the F3-F4 communication line
2. 24VAC (requires field provided external 24VAC transformer).
3. One MIM-A60UN per 24VAC transformer

C. Dimension:

1. The thermostat adapter shall be approximately (W X H X D): 5" X 5 1/8" X 1 1/2" in size.

4.02 EXTERNAL CONTACT CONTROL INTERFACE MODULE (MIM-B14, MIM-B14U)

A. Function:

1. Indoor unit control/monitoring
 - (a) Control option to enable/disable and monitor a single indoor unit.
 - (b) Direct indoor unit control by external dry contact, 0 volts OPEN/CLOSE signal.
 - (c) Emergency control with simple contact input.
 - (d) Unoccupied room control with applicable indoor units.
 - (e) Supplemental, external heat control output with applicable indoor units.
 - (f) Indoor unit operation (thermal or operation)/error state output through relay contacts.
2. Outdoor unit control/monitoring
 - (a) System error monitoring (dry output).
 - (b) Manual nighttime quiet mode activation (for applicable systems).

B. Connection:

1. Installs inside or on the side of a single indoor unit.
2. Installs inside a MAIN outdoor unit.
3. Connection to indoor unit with included wire harnesses.

END OF SECTION

This Page Blank

Section 23 3113
Metal Ducts

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Sealants and gaskets.
 - 5. Hangers and supports.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports and seismic restraints shall be per Unistrut OSHPD Pre-Approved OPM-0295-13.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2022.

1.04 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Ductwork materials
 - 2. Sealants and gaskets.
- B. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Structural members to which duct will be attached.

1.05 QUALITY ASSURANCE

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

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2022, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2022, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
 - f. Omni Duct Systems.

2.02 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G60 or G-90 at exterior.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
 3. Beaded coupling connections sealed with high-temperature silicone.
- C. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- D. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- E. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- F. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

- G. Self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.03 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide a product by one of the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Ductmate Industries, Inc.
 - 3. Hilti Corp.
 - 4. Mason Industries.
 - 5. Unistrut Corporation; Tyco International, Ltd.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.02 DUCT SEALING

- M. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- N. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Conditioned Space, Exhaust Ducts: Seal Class B.

3.03 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.04 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces per Unistrut OSHPD Pre-Approved OPM-0295-1.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

3.05 CONNECTIONS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.
- B. Paint exterior of metal ducts to match adjacent surface. Verify color with school district. See painting specifications.

3.07 DUCT SCHEDULE

- A. Elbow Configuration:
 - 1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.
- B. Branch Configuration:
 - 1. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."
 - a. Velocity 1000 fpm or less 45-degree lateral.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- C. Duct system will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Duct accessory hardware.
 - 3. Flange connectors.
 - 4. Turning vanes.
 - 5. Flexible connectors.
 - 6. Penthouse Louvers
- B. Related Sections:
 - 1. Division 23 Section "Metal Ducts".

1.03 SUBMITTALS

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

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60 (Z180) and G90 (Z275).
 - 2. Exposed-Surface Finish: Mill phosphatized.

- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.02 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. McGill AirFlow LLC.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Pottorff; a division of PCI Industries, Inc.
 - f. Ruskin Company.
 - 2. Standard leakage rating.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Single blade for ducts up to 24". Multiple blades for ducts greater than 24".
 - b. Opposed blade design for multiple blade dampers.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Galvanized steel.
 - 9. Where damper is not accessible install remote damper operator adjustment assembly.

2.03 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.04 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Ductmate Industries, Inc.
- C. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- D. Material: Galvanized steel for galvanized steel ducts.
- E. Material: Stainless steel for stainless steel ducts.
- F. Gauge and Shape: Match connecting ductwork.

2.05 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.
- E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.06 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
 - 2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.07 PENTHOUSE LOUVER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ruskin.
 - 2. Aluminum Louvers, aluminum roof, bird screen with 8" high sheet metal curb, custom baked enamel finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and stainless-steel accessories in stainless-steel ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Connect ducts to duct silencers rigidly.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot (15-m) spacing.
 - 8. Upstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.

- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
 - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
 - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
 - 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
 - 5. Body Access: 25 by 14 inches (635 by 355 mm).
 - 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- J. Label access doors according to Division 22 Section "Identification for Plumbing Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Inspect turning vanes for proper and secure installation.
 - 4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 3713
DIFFUSERS, REGISTERS, GRILLES, AND LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Ceiling Diffusers.
- B. Related Sections:
 - 1. Division 23 Section "Air Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For louvers to verify color selected.
- D. Source quality-control reports.

PART 2 - PRODUCTS – SEE SCHEDULE ON PLANS

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications including but not limited to, raceways, boxes, enclosures, feeders, branch circuiting, supports, terminal cabinets, sleeves, gutters, panels, transformers, switchgear, lighting fixtures, controls, relays, contactors, in order to complete and make fully functional the systems described.
 - 2. Lighting systems as shown on the plans and as specified herein, including controls, occupancy sensors, photocell controls, LED's, drivers, supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
 - 3. Duct banks and raceways for all power and lighting systems as shown and/or required. Duct banks shall include all trenching, conduit, concrete, backfill, boxes, pads, substructures required for a fully developed and useable pathway for cables, conductors, as shown on site, etc.
 - 4. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, cooling towers, system pumps, condensing units. Provide protective equipment unless otherwise noted, etc. including protective devices. Contractor to review Mechanical and Plumbing drawings and specifications as part of this project, confirm all required electrical and fire alarm connections and include with bid.
 - 5. Plumbing Electrical: Conduit, conductors and terminations for plumbing equipment with power requirements including necessary fusible and/or non-fusible safety disconnect devices. Provide motor starters where required. Contractor to review Plumbing drawings and specifications as part of this project, confirm all required electrical and fire alarm connections and include with bid.
 - 6. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to switchgear, panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
 - 7. Lighting acceptance testing, documentation and completion of required forms as specified in Section 26 5670, LIGHTING ACCEPTANCE TESTING.
 - 8. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property. Minimum two week advance notice shall

be coordinated with the Owner and his representatives. Training shall be as outlined in individual system specifications identified to follow.

- B. Related Sections Under Other Divisions:
 - 1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
 - 2. Painting of electrical equipment where exposed and required by the Architect to be painted as described elsewhere in the specification.
 - 3. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical specifications, shall be furnished and installed as required by Division 25 and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26 (the BAS systems and components are installed in accordance with Division 25).
 - 4. Smoke Fire Dampers: Verify all required locations and coordinate with Mechanical plans for points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).
 - 5. Duct mounted smoke detectors: Coordination with Mechanical plans for exact locations and points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).

1.03 SYSTEM DESCRIPTION

- A. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.
- B. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

1.04 SUBMITTALS AND SHOP DRAWINGS

- A. Before construction, submit in accordance with the General Conditions of this Specification: A complete list of all materials proposed to be furnished and installed under this section.
- B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
 - 1. Site utility work equipment including ducts, conduits, fittings, concrete manholes, concrete pullboxes, vaults, accessories, etc.
 - 2. Distribution equipment including transformers, distribution panels and breakers, branch circuit panels, grounding, surge protection devices, etc.
 - 3. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
 - 4. Lighting equipment including fixtures, LED's, drivers, mounting accessories, color charts (where required), etc.

5. Lighting control equipment including low voltage switching system, dimmer switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
 6. Constructability review letter/comments for lighting acceptance testing as required by Section 26 5670, LIGHTING ACCEPTANCE TESTING.
 7. Complete system component submittals and shop drawings specific to this project for:
 - a. Fire Alarm System
 - b. Occupancy sensor drawings.
 - c. Network lighting controls.
 8. Conduit including all fittings, etc.
 9. Wiring and cable, terminations, etc.
 10. Fire rating penetration materials, details, etc.
- C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Samples of the proposed and substitute materials may be required for inspection prior to approval. Costs, if any, for evaluation of substitutions shall be the Contractor's responsibility. The decision of the Architect shall be final. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.
- D. SUPPORTING DEVICES
1. Where walls, floor, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the submittals must include spacing, static loads and seismic loads at all attachment and support points, refer to details 5, 7, 8, 9 sheet E-501, and detail 1 sheet E-502 for site specific details.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.
- B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, supply

the current product model or series which meets the specification and intended use of the specified component.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent apprised of changes or clarifications, etc.
- B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards.
 - 1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.
 - 2. Before each journeyman electrician commences work, deliver to Owner at the project site, a photocopy of the journeyman's valid Pocket Card.
- C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction. Refer to general conditions of specifications.
- D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Any damage which results must be properly repaired at no extra cost to the Owner. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.
- E. Supporting Devices:
 - 1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
 - 2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical

- luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.
3. Do not use other trade's fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
 4. Support conduits within 18" of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8' spacing.
 5. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
 6. Provide seismic bracing per CBC requirements for this location, and as per structural engineer.
 7. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing shall be per Structural Engineer.
- F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.
- G. Engineer's Field Observation: When Electrical Engineering representative performs a field observation, the Electrical Contractor shall be present and available to remove equipment covers as needed.
- H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date on a daily basis reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.
- I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm system cabinets, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 0553, IDENTIFICATION OF ELECTRICAL SYSTEMS.
- J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc. The Contractor shall hold all parties harmless of negligent safety practices that may cause injury to others on or near the job site.
- K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be

repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.

- L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance for each system installed as part of this project. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.
- M. In service training: Provide in service training to Owner's Staff for each system installed as part of this project.
- N. Lighting Acceptance Testing: Provide two copies of lighting acceptance testing results and equipment operating manuals as specified in Section 26 5670, LIGHTING ACCEPTANCE TESTING. Instruct the Owner on operation of control systems as noted above.

END OF SECTION

SECTION 26 0501

SELECTIVE ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Electrical demolition.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work shall be as specified in individual sections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor to walk job to observe existing conditions and account for variances discovered from drawings as needed.
- B. Verify field measurements and circuiting arrangements as shown on drawings.
- C. Verify that abandoned wiring and equipment serve only abandoned facilities, completely remove all abandoned wiring and cabling for systems no longer in use.
- D. Demolition Drawings are based on limited field observation and existing record documents. Field verify and report any discrepancies to Owner/Architect before disturbing existing installation.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

- B. Coordinate system service outages directly with owner.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, observe provisions of NFPA 70E and CALOSHA, use personnel experienced in such operations.
- D. Existing Electrical Service: Disable system only to perform work as shown on drawings. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required (where applicable).
- E. Existing Fire Alarm System: Coordinate outages with Owner and local fire department. Notify Owner/Owner's representative at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. It is the contractors responsibility as a means and methods process to disable and systematically remove the existing building fire alarm system and devices in order to complete the work as described and meet the project schedule.
- F. Existing Communications System: Disable system only to perform work as shown on drawings. Notify Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of this section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Allow the owner first right to retain ownership of all salvaged materials, otherwise the Electrical Contractor is responsible for its removal from the site and proper disposal or recycling.
- D. Remove abandoned wiring to source of supply.
- E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- G. Disconnect and remove abandoned panelboards and distribution equipment.
- H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

- J. Discarded electrical components and lamps containing hazardous waste (i.e., mercury in fluorescent lamps) shall be disposed of as required by the State Laws and Local Ordinances regarding hazardous materials.
- K. Repair adjacent construction and finishes in kind damaged during demolition and extension of work.
- L. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- M. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide blank plates for all vacant circuit breaker positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires: Cleaning light fixtures. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry.

3.05 INSTALLATION

- A. Install relocated materials and equipment as shown and/or as required.

END OF SECTION

THIS PAGE INTENTIONALL LEFT BLANK

SECTION 26 0519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Wires and cables.
 - 2. Connectors.
 - 3. Lugs and pads.

1.03 SYSTEM DESCRIPTION

- A. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.04 SUBMITTALS

- A. Provide product data for the following equipment:
 - 1. Wires.
 - 2. Cables.
 - 3. Connectors.
 - 4. Lugs.
 - 5. Splice Kits.
 - 6. Strain Relief Fittings.
- B. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).
- B. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.
- B. Connectors: Burndy, Ilsco, Thomas & Betts, or approved equal.
- C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 volt, 105 degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.
- D. Splices:
 - 1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
 - 2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
 - 3. Screw Terminal Lugs.
 - 4. Kearney Split Bolt.

2.02 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS. WIRE AND CABLE SHALL BE:

- A. Copper, 600 volt rated throughout. Conductors 12AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
- B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger. Neutrals shall be solid white with color stripe as indicated.

C. Color Code Conductors as Follows:

		Phase			Neutral		Ground
	A Ph	B Ph	C Ph	A Ph	B Ph	C Ph	
208/120V							
3 Ph	Blk	R/Blk	BL	W/Blk	N.A.	W/BL	Grn
240/120V							
1 Ph	Blk	R	N.A.	W/Blk	W/R	N.A.	Grn
480/277V	Brn	Org	Yel	Gry/Brn	Gry/Org	Gry/Yel	Grn
Blk = Black, R = Red, BL = Blue, Grn = Green, Brn = Brown, Org = Orange, Yel = Yellow, Gry = Grey, W = White							

- D. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600-volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (waterproof, wet location, plenum, temperature rated, etc.). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.
- E. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.

2.03 CONNECTORS

- A. Copper Pads: Drilled and tapped for multiple conductor terminals.
- B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.
- C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 12 through 8AWG.

2.04 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.
- B. Insulation: Use proper insulation types where temperature and environment are a factor.
- C. Splices at or below grade level are not allowed.
- D. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. In pullboxes and vaults, provide embossed brass tags identifying system serviced and function. See Section 26 0553 IDENTIFICATION OF ELECTRICAL SYSTEMS.
- E. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non waterproof cabling is not allowed in any below grade or wet application.
- F. Cable and conductors routed through pull boxes and vaults shall be properly supported on porcelain or equal insulators mounted on steel rack inserts. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.
- G. Wires and Cables:
 - 1. Conductor Installation:
 - a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
 - b. Install conductors with care to avoid damage to insulation.
 - c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
 - d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
 - 2. Conductor Size and Quantity:

- a. Install no conductors smaller than 12AWG unless otherwise shown.
 - b. Provide all required conductors for a fully operable system.
3. Provide dedicated neutrals (one neutral conductor for each phase conductor).
4. Conductors in Cabinets:
 - a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
 - b. Tie and bundle feeder conductors in wireways of panelboards.
 - c. Hold conductors away from sharp metal edges.
 - d. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Notice of Completion.

3.02 FIELD QUALITY CONTROL

- A. Tests:
 1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.
 2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION

Project Name: Oxnard College OE Building Alterations

Job Number: 3244-01-ED24

Section 26 0519

THIS PAGE INTENTIONALL LEFT BLANK

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
 - 2. "Grounding electrode system" refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
 - 3. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.
- B. Related Work:
 - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

2.02 GROUND RODS

- A. Copperclad steel, 3/4" diameter by 10' long, conforming to UL 467 unless otherwise noted on drawings and details.
- B. Quantity of rods shall be as required to obtain the specified ground resistance or additional rods shall be driven to obtain specified resistance or less.

2.03 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

PART 3 - EXECUTION

3.01 GENERAL

- A. Ground in accordance with the CEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.02 INACCESSIBLE GROUNDING CONNECTIONS

- A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.03 SECONDARY EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
 - 1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
 - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.

- C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting grounding conductors.
- D. Switchgear, Switchboards:
 - 1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
 - 2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
 - 3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- E. Transformers:
 - 1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 - 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to nearest component of the grounding electrode system and the ground bar at the service equipment.
- F. Conduit Systems:
 - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
 - 2. Non metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
 - 3. Metal conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power and lighting branch circuits.
- H. Boxes, Cabinets, Enclosures, and Panelboards:
 - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
 - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 - 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures

connected with flexible conduit shall have a green ground wire included with the conductors from the fixture through the flexible conduit to the first outlet box.

- L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.04 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.05 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth, not less than 9 1/2' in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

END OF SECTION

SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Conduit and fittings.
 - 2. Outlet boxes.
 - 3. Weatherproof outlet boxes.
 - 4. Junction and pull boxes.
 - 5. Floor boxes and poke-through.
 - 6. Cabinets, termination cabinets.
 - 7. Gutters.
 - 8. Concrete boxes and vaults.
- B. Related Work:
 - 1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground on site and offsite, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
 - 2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
 - 3. Raceways/boxes described by this section shall include, but not be limited to, power for site utilities and lighting, controls, fire alarm, power distribution, lighting, lighting controls, and other building low voltage/communications systems controls as may be required. Raceways, boxes and duct paths required for utility companies shall be installed per plans unless utility company requirements are more restrictive at which time those requirements shall take precedence.
 - 4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.
 - 5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor's responsibility as a means and methods process to

- coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, perlins, grade beams, etc.
6. It is the Contractor's responsibility to insure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.
 7. Trenching and backfilling for all underground conduit systems installed by the Electrical Contractor shall be the responsibility of the Contractor. Conduits shall have minimum cover requirement of 36" below finish grade. Refer to details on drawings for conduits in trench requirements. Locations of existing underground (UG) utility systems shall be determined by calling Underground Service Alert (USA) at least 48 hours prior to any excavation.
 8. Minimum conduit size shall be 1/2" except if plan shows or code requires larger size. Exception: Use minimum 3/4" for underslab and below grade applications outside of building exterior walls.
 9. All lighting, electrical, and fire alarm systems shall be installed in a metallic conduit system dedicated for each system. Open cabling is allowed for low voltage lighting control cabling only above accessible ceiling spaces.
 10. All line voltage wiring within the building shall be installed in metallic conduit systems.
 11. All conduit, concrete pads, underground concrete shall be furnished and installed with the approved materials and type for the application. Provide proper traffic control during construction as well as barriers and protection of all excavations and trenching.
 12. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8" polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
 13. Exterior installations: After conductors are installed, seal conduit ends to prevent entrance of foreign material using pliable duct seal, caps or waterproof expanding foam.
 14. All systems including lighting, lighting controls, power distribution, fire alarm, etc. shall be in dedicated conduit systems.
 15. Underground conduits entering building shall have the open end of conduit within building above the elevation of the conduit outside the building such that water cannot enter building through conduit. If such a condition exists, a pull box outside of building footprint shall be installed in conduit route before conduit enters building whereby top of pull box is below finish floor of building and moisture may exit box before entering building.
 16. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
 17. Separate Raceway System: Provide a separate dedicated raceway system for each system installed, do not combine different systems into a raceway system.
 18. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked, and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.
 19. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.
 20. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 300, 312, 314 and 366 except as noted otherwise.

21. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
22. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

1.03 SUBMITTALS

- A. Provide Shop Drawings and Product Data for the Following Equipment:
 1. Conduit and fittings.
 2. Outlet boxes.
 3. Weatherproof outlet boxes.
 4. Junction and pull boxes.
 5. Floor boxes and poke-through.
 6. Cabinets, termination cabinets.
 7. Gutters.
 8. Concrete boxes and vaults.
 9. Putty pads.
 10. Raceways

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or other independent and nationally recognized testing firm.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.
- B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.
- C. Galvanized Rigid Steel (GRS) conduit shall be PVC Coated, hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
- D. Electrical Metallic Tubing (EMT) shall be color coded as indicated, zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
- E. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards.

- F. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350.
- G. Manufacturers:
1. Outlet Boxes: Bowers, Raco, Steel City or equal.
 2. Weatherproof Outlet Boxes: Bell, Red Dot, [Carlon] or equal.
 3. Floor Boxes: Wiremold/Walker, Hubbell, Steel City, or equal.
 4. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
 5. Box Extension Adapter: Bell, Red Dot, [Carlon] or equal.
 6. Conduit Fittings: O-Z Gedney, Thomas & Betts, or equal.
 7. Vaults: Christy, Brooks, Utility Vault or equal.
 8. Putty pads: 3M, Hilti, or equal.
 9. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
 10. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
 11. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
 12. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
 13. Flexible Metal Conduit (FMC), Alflec, American Flexible Conduit or equal.
 14. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liqueatite or equal.
 15. Floor Boxes, Single Gang, Walker/Wiremold 880 CS Series or approved equal.
 16. Floor Boxes, Multiple Gang, Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers.
 17. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.
 18. Exterior In-Grade Boxes for Non-Utility Company, Precast concrete or polymer concrete, Utility Vault and Christy.

2.02 OUTLET BOXES

- A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.
- B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as "MYERS" gasketed type hub or equal.
- C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4" square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco Series 681 and 686 or equal. Refer to drawings for data/communication outlet boxes.
- D. Luminaire Outlet: minimum 4" square with correct plaster ring depth, minimum 1 1/2" deep with 3/8" luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.

- E. Multiple Devices: Three or more devices at common location. Install 1 piece gang boxes with 1 piece device plastering. Install one device per gang unless otherwise allowed.
- F. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.
- G. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.03 WEATHERPROOF OUTLET BOXES

- A. Construction: Provide corrosion-resistant cast iron, with zinc finish, weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, zinc, galvanized finish.
- B. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner. Weatherproof boxes in wet locations as described in CEC 406.9 (B) shall be provided with a “while-in-use” cover; red dot ‘CK’ Series of aluminum die-cast construction, NEMA 3R, with lacquer finish.

2.04 JUNCTION AND PULL BOXES

- A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.
- B. Location:
 - 1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
 - 2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
 - 3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24” shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
 - 4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.05 BOX EXTENSION ADAPTER

- A. Construction: Cast iron with gasket.
- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.06 CONDUIT FITTINGS

- A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.
- B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.07 FLOOR BOXES - SINGLE GANG

- A. Construction: Deep cast iron fully adjustable before and after concrete pour with all required components for complete activation. Verify required components for application of service fittings, covers, monuments, and the like, attached to floor boxes.
- B. Activations:
 - 1. Flush: Provide brass duplex or single signal cover, hinged with set screw lock. Carpet or tile finish ring.
 - 2. Monuments: Provide stainless steel monuments with power receptacle or data grommet as noted.
 - 3. Coordinate specific application of systems as noted on Drawings.
- C. Location: Concrete floor. Use poke-thru of same construction in non-concrete structure. Verify exact locations. Ensure flush with finish surface.

2.08 FLOOR BOXES - MULTIPLE GANG

- A. Construction: Deep cast iron, fully adjustable before and after pour. Equal to Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers. Verify color. Partition for different power or signal applications. Provide required power receptacle devices and signal grommets or receptacles as noted. Flange type shall be compatible with floor covering for either carpet or vinyl as required and shall be brass type not polycarbonate.
- B. Floor mounted boxes shall be water tight and cast iron when installed in grade level concrete slab floor, fully adjustable with interior and exterior leveling screws. Receptacle flange shall be brass with a duplex lift lid. Flange type shall be compatible with floor type. Before installation, coordinate exact location with Architect.

2.09 EXTERIOR IN-GRADE BOXES FOR NON-UTILITY COMPANY USE SHALL BE:

- A. Precast concrete or polymer concrete type with full bottoms and draining into gravel drywell. . Pull boxes 24" x 36" and larger shall have full bottom, set on a minimum of 24" of crushed rock with drainage as detailed on plans.
- B. Flushmount in hardscape and 1" above grade in softscape.
- C. Provided with full vehicular type cover, stamped with "ELECTRIC", "LIGHTING", "COMMUNICATIONS", etc. cover identification as shown on the drawings or as applicable.
- D. Provided with brass hold-down bolts in cover.
- E. Provided with necessary box extensions to gain proper depth.
- F. Seal all conduit in underground boxes with duct seal after conductors have been installed.

2.10 PUTTY PADS

- A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.
- B. Designed to install around outside of outlet boxes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as Educational, Health Care, wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without the permission and approval of the Architect. All conduits shall be concealed except in electrical and telecommunication rooms. All Metallic Conduit installed below grade shall be PVC coated type.
- B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Minimum 4" of bedding and cover of backfill material 1/4" size grain and smaller maximum. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits

shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints.

- C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8'-0" above finished grade to 18" below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8' above grade at 5' intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be Pvc Coated Type..
- D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be steel insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1" and two hole conduit straps are required for size 1 1/4" and larger. EMT shall not be allowed in areas subject to physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits. EMT shall be color coded as follows: Yellow – 277/480Volts, Red – Fire Alarm Circuits, Silver – 120/208Volts, Blue – Low Voltage Circuits (Under 50Volts).
- E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual run from distribution panel to last device shall exceed a cumulative length of 6' of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6' of flexible metal conduit extending from junction box to fixture.
- F. Underground conduits and transition to above grade/slab shall be:
 - 1. GRS elbows.
 - 2. GRS risers from GRS elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
 - 3. GRS elbows/risers to be PVC coated or 10 MIL taped wrapped (1/2" lapped) to 3" above finish grade or top of slab.
- G. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means

of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.

- H. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.
- I. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings.
- J. Conduit Seals: Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
 - 1. Provide damming material around conductors 3" into conduit.
 - 2. Fill 3" of conduit with 3M #2123 sealing compound.
 - 3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
 - 4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
 - 5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
 - 6. Provide cable drip loop minimum 12" high.
- K. Marker tape: Place plastic yellow marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.
- L. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed, however 18" on all sides of a utility crossing must be concrete encased.
- M. Duct bank defined here-in shall be four or more conduits in a common trench, conduit spacers and saddles shall be required in all trenches where more than two conduits over 2" in diameter travel in the same trench. Proper spacing between systems as outlined above shall be required and spacers shall be located each 5' (maximum) along trench route from point to point.
- N. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.
- O. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.

- P. Expansion Joints
1. Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
 2. Provide conduits smaller than 3" with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between the end. All conduit shall have a copper green grounding bonding conductor installed.
- Q. Seismic Joints
1. At seismic joints, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes or approved fittings, on both sides of the joint. Connect conduits to junction boxes with sufficient slack flexible conduit such that these slack conduits are 1 1/2 times the distance between conduit ends. Flexible conduit shall have a copper green ground bonding jumper installed.
- R. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- S. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- T. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.
- U. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.
- V. Mount heights of outlet boxes, unless otherwise required by ADA, shall be as noted on drawings.
- W. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.
- X. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.
- Y. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION

SECTION 26 0534

CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Cabinets where shown on the contract drawings and specified herein.
- B. Related Work:
 - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 0553, IDENTIFICATION OF ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Type: Cabinets shall be flush or surface mounted type as indicated on the contract drawing, as per Code and U.L. Standard 50.
- B. Cabinet Construction: Sizes as indicated, constructed of code gauge sheet steel with hinged lockable doors, common keyed with panelboards. Equip cabinets with 3/4" fire retardant treated plywood backboards and/or barriers as applicable, terminal blocks for connection; index card holders and cards mounted behind heavy plastic on inside of cabinet doors.
- C. Finish: Cabinets shall be chemically cleaned and the fronts shall be finished in same way as panelboards and switchboards.
- D. Controls: As indicated on the contract drawings.
- E. Identification: Provide on exterior of cabinet doors engraved plastic nameplate identifying the cabinet as designated on the Contract Drawing. Lettering shall be white on black finish and shall be minimum 3/16" high. Affix nameplates to cabinet doors with a minimum of two escutcheon pins or screws.

PART 3 - EXECUTION

3.01 GENERAL

- A. Required: To be located where indicated on the Contract Drawing and installed as per manufacturer's instruction. Securely fasten to structural members or Unistrut support in vertical and plumb position and at heights indicated.
- B. Nameplates: Conform to provisions noted above or as designated on the plans.

END OF SECTION

SECTION 26 0553

IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
 - a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
 - 1) Enclosures for transformers, switchboards, panels, pullboxes, cabinets.
 - 2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
 - 3) Wall switches not within sight of outlet controlled.
 - 4) Special systems such as, but not limited to, telephone, fire alarm, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
 - 5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
- B. Related Work:
 - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 0534, CABINETS.
 - 3. Section 26 2413, SERVICE AND DISTRIBUTION SWITCHBOARD.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABEL DESIGNATIONS

- A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.
- B. Panelboard labels showing panel designation, voltage, phase and source.

- C. In accordance with CEC, provide arc flash protection warning labels on all switchboards, panelboards, distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.02 MATERIALS

- A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.
- B. For Emergency Equipment: Use engraved white letters over red background.
- C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel finish.
- D. Arc flash labels shall be provided as required by CEC Article 70E.

PART 3 - EXECUTION

3.01 MOUNTING

- A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.

3.02 HEIGHTS ON LABELS

- A. Panelboards, Switchboards and Special Systems Enclosures: 1/4" identify equipment designation; 1/8" identify voltage rating and source.
- B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16" identify circuit and load served, including location of equipment.
- C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16" identify load served.
- D. Transformers: 3/16" identify equipment designation; 1/8" identify primary and secondary voltages, primary source and secondary load. Include location of primary source or secondary load if remote from transformer.

3.03 WARNING SIGNS

- A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.
- B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16" stroke minimum.

- C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Panelboards.
 - 2.
- B. Related Work:
 - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
 - 3. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
 - 4. Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.03 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Underwriters Laboratories, Inc. (UL):
 - 1. No. 50 Enclosures for Electrical Equipment
 - 2. No. 67 Panelboards
 - 3. No. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures
- C. National Fire Protection Association (NFPA):
 - 1. No. 70-2022 California Electrical Code (CEC)
- D. National Electrical Manufacturers Association (NEMA):
 - 1. No. PB-1 Panelboards.
 - 2. No. AB-3 Molded Case Circuit Breakers and Their Application.

PART 2 - PRODUCTS

2.01 PANELBOARDS

- A. Panelboards shall be in accordance with UL, NEMA, NEC, CEC and as shown on the drawings. Approved manufacturers are ABB and Eaton.
- B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- C. All panelboards shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.
- D. All panelboards shall be completely factory assembled with molded case circuit breakers. All factory wiring shall be checked for correct tightness and visually inspected to insure that bussing and terminations have not become loose in transit to job site.
- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings. Refer to single line diagram and panel schedules on drawings. Terminals shall be minimum 75 degree rated. Back fed main circuit breakers are not allowed. Main circuit breakers shall be vertically mounted.
- F. Panelboards shall have the following features:
 - 1. Nonreduced size solid copper bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
 - 2. Full size neutral bar, mounted on insulated supports.
 - 3. Ground bar with sufficient terminals for all grounding wires. Buses braced for the available short circuit current.
 - 4. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 30 amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps. Where used for heating and air conditioning, and refrigeration equipment, use only HACR type U.L. listed circuit breakers.
 - 5. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping.
 - 6. Where designated on panel schedule as "space", include all necessary bussing, device support and connections. Provide blank cover for each space.
 - 7. Series rated panelboards are not permitted.
 - 8. Label all panels in accordance with Section 26 0553, IDENTIFICATION OF ELECTRICAL SYSTEMS.
 - 9. Panel spare conduit: Provide (1) ¾ inch spare conduit stubbed to accessible ceiling space and/or interstitial space below floor for every (5) spaces and spares indicated on panel schedules.
- G. Panelboards serving as building mains shall be "service entrance rated" and UL Listed as "service equipment".

2.02 CABINETS AND TRIMS

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
2. All ventilated openings in panelboards and switchboards, shall be furnished with dust filters to prevent entrance of dust and debris.
3. Cabinets for panelboards may be of one piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide necessary hardware for "in" and "out" adjustment of panel interior.
5. Cabinets for two section panelboards shall be arranged side by side, and shall be the same height. Flush mounted cabinets should be 1 1/2" apart and coupled by conduit nipple.
6. Gutter size in panel boxes, on all sides, shall be in accordance with the CEC. Penetrations through gutter to live area of the panelboard shall incorporate approved non-metallic-grommet type of insulation to protect wire passing through.

B. Trims:

1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
2. Flush trims shall overlap the box by at least 3/4" all around.
3. Surface trim shall have the same width and height as the box.
4. Flush or surface trims shall not have ventilating openings.
5. Secure trims to back boxes by indicating trim clamps.
6. Provide a welded angle on rear of trim to support and align trim to cabinet.
7. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.

C. Doors:

1. Provide doors with flush type latch and manufacturer's standard lock. Doors over 48 inches in height shall have a vault handle and a three-point catch, arranged to fasten door at top, bottom, and center.
2. In making switching devices accessible, doors shall not uncover any live parts.
3. Provide concealed hinges welded to the doors and trims.
4. For lighting or power contactors incorporated in panelboards, provide separate doors for the contactors.
5. Provide keyed alike system for all panelboards.
6. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

D. Painting:

1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.03 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

- A.** Breakers shall be UL listed and labeled, in accordance with the CEC, as shown on the drawings, and as specified.

- B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.
 - 1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated.
 - 2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3 times to 10 times for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.
- C. Breaker features shall be as follows:
 - 1. Integral housing of molded insulating material.
 - 2. Silver alloy contacts.
 - 3. Arc quenchers and phase barriers for each pole.
 - 4. Quick-make, quick-break, operating mechanisms.
 - 5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
 - 6. Electrically and mechanically trip free.
 - 7. An operating handle which indicates ON, TRIPPED, and OFF positions.
 - a. Line connections shall be bolted.
 - b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings. The interrupting rating shall not be less than the minimum identified requirement.
 - 8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

2.04 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in accordance with CEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes and layout of cabinets within the designated spaces. All equipment must be dimensioned in order to physically fit in the spaces provided and to comply with all code required clearances.

- C. Install a typewritten schedule of circuits in each panelboard. Include the room numbers (as finally described by the Owner) and items served on the cards. Obtain final room numbers from Architect prior to creating schedule.
- D. Mount the panelboard so that maximum height of the top circuit breaker above finished floor shall not exceed 78 inches.
- E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- F. Circuit numbers shall correspond to the approved panel schedule. Provide as-built drawings showing the actual circuit numbers being used for each device on each branch circuit if changes are required.
- G. Verify depth of all flushmounted enclosures in walls to be certain wall depth will accommodate panel depth prior to installation.
- H. All openings in switchgear and panelboards that are unused shall be sealed with bolts and washers. Use caulking where holes or openings cannot be sealed by way of a washer, or bolts or conduit seals.
- I. Contractor shall include the services of an independent testing company to test GFI circuit breakers in distribution and main panelboards.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Wiring devices.
- B. Related Work:
 - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
 - 3. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
 - 4. Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.01 RECEPTACLES

- A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
 - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
 - 2. Receptacles shall be of a screw terminal type, "pressure type quick wire" terminations are not allowed.
 - 3. Duplex receptacles shall be premium specification grade single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
 - 4. Wiring device color selection to be provided by Architect. Contractor to verify device color with Architect prior to procurement.
 - 5. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
 - a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It

shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.

- B. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.
- C. Weatherproof Receptacles: Shall consist of a listed cast aluminum weather resistant duplex receptacle, mounted in box with a gasketed, weatherproof, cast, while in use cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap.

2.02 SWITCHES AND DIMMERS

- A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified.
 - 1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and be of a screw terminal type.
 - 2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
 - 3. Ratings:
 - a. 120 volt circuits: 20 amperes at 120-277 volts AC.
 - b. 277 volt circuits: 20 amperes at 277 volts AC.
 - 4. The switches shall be mounted on the strike plate side of doors.
 - 5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.
 - 6. All toggle switches shall be of the same manufacturer.

2.03 WALL PLATES

- A. Wall plates for switches and receptacles shall be nylon.
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
- C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.
- D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.
- E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas all receptacles shall be dust proof and or waterproof where applicable.
- F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in accordance with the CEC, NECA "Standard of Installation", and as shown as on the drawings.
- B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.
- C. General: Devices shall be of the type specified herein. All devices shall be installed with "pigtailed" leads from the outlet box. No device shall be used in the "feed through" application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.
- D. Installation: Devices and plates shall be installed in a "plumb" condition and must be flush with the finish surface of the wall where boxes are recessed.
- E. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights are indicated on plans.
- F. Install receptacles with the ground down.
- G. Install switches with the off position down.
- H. Clean debris from outlet boxes.
- I. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.
- J. Test each receptacle device for proper polarity.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 5100

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Interior lighting systems, including luminaires, drivers, lamps and emergency lighting equipment.
- B. Related Work:
 - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
 - 3. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
 - 4. Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
 - 5. Section 26 5600, EXTERIOR LIGHTING.
 - 6. Section 26 5670, LIGHTING ACCEPTANCE TESTING.

1.03 SUBMITTALS

- A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting, details, materials, terminations, wiring and connection diagrams, photometric data, ballasts, luminaires, lamps and controls.

1.04 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM).
- C. American National Standards Institute (ANSI).
- D. Aluminum Association Inc. (AA).
- E. Illuminating Engineering Society of North America (IESNA).
- F. National Electrical Manufacturers Association (NEMA).
- G. National Fire Protection Association (NFPA).
- H. Underwriters Laboratories, Inc. (UL).

1.05 MAINTENANCE

- A. Provide 10 percent spare drivers for each type of lighting fixture provided or a minimum of one spare driver per each type of fixture, (whichever is greater), as loose items in manufacturers packaging to the owner. Deliver the product(s) to a location acceptable to the Owner.

1.06 DEFINITIONS

- A. Lighting terminology used herein is defined in IES
- B. Exception: The term “driver” is used herein to cover both drivers and power supplies, where applicable.
- C. Clarification: The term “LED light source(s)” is used herein per IES to cover LED package(s), module(s), and array(s).

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.

2.02 LIGHTING FIXTURES (LUMINAIRES)

- A. Shall be in accordance with NFPA 70, UL 1598 and shall be as shown on drawings and as specified. All luminaires shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards as per California Code of Regulations Title 24, Part 6, Section 111 referencing the Appliance Efficiency Regulations in Title 20. Post certification with building permit.
- B. Sheet Metal:
 - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
 - 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 - 3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 - a. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.
- C. Recessed fixtures shall be of the type approved for the ceiling and insulation conditions and appropriate for the installation location. Insulation must be held back from the fixture to provide manufacturers' recommended clearances for proper operation. Thermal tripping shall be the installer's responsibility to correct. Where installed in fire rated ceilings, coordinate installation of fire rated enclosures around the ceiling penetrations. Fixtures shall contain the proper through wiring capacity for that which is shown on the plans.
- D. Recessed fixtures shall be provided with the appropriate trims and hardware compatible with the ceiling type shown. Plaster frames are required where plaster or gypsum board ceilings are encountered.
- E. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- F. Metal Finishes:
 - 1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
 - 2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise specified on the drawing.
 - 3. Exterior finishes shall be as shown on the drawings.
- G. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- H. Light Transmitting Components for Fixtures:
 - 1. Shall be 100 percent virgin acrylic plastic or water white, annealed, crystal glass.

2. Flat lens panels shall have not less than 1/8 inch of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
 3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- I. Recessed LED fixtures shall be manufactured specifically for LED lamps with ballasts or drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion. Fixtures shall be designed for lamps as specified.
 - J. Provide fixtures with a U.L. listing for shower or shower rating above shower or tub areas.

2.03 LED LUMINAIRE REQUIREMENTS

- A. General Requirements:
 1. Luminaire shall have an external label per ANSI C136.15
 2. Luminaire shall have an internal label per ANSI C136.22.
 3. Luminaires shall start and operate in -20°C to +40°C ambient.
 4. LED light source(s) and driver(s) shall be RoHS compliant.

2.04 LED DRIVER

- A. Driver
 1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures as indicated.
 2. Shall accept the voltage or voltage range indicated, and shall operate normally for input voltage fluctuations of plus or minus 10 percent. Consistent with NEMA SSL 1.
 3. Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.
- B. Electromagnetic interference
 1. Shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
 2. Shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
- C. The following shall be in accordance with corresponding sections of ANSI C136.37
 1. Wiring and grounding
 2. All internal components shall be assembled and pre-wired using modular electrical connections.
 3. Mounting provisions
 4. Terminal blocks for incoming AC lines
 5. Latching and hinging
 6. Ingress protection

2.05 LAMPS

A. LED LIGHT SOURCE

1. Minimum Color Rendering Index (CRI): 60.
2. Correlated Color Temperature (CCT)
 - a. CCT shall be as listed in Table 1 below:

Table 1. Allowable CCT

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values <u>Measured CCT (K)</u>
2700	2580 to 2870
3000	2870 to 3220
3500	3220 to 3710
4000	3710 to 4260
4500	4260 to 4746
5000	4745 to 5311
5700	5310 to 6020
6500	6020 to 7040

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation and furnishing of lighting fixtures shall be in accordance with the CEC, manufacturer's instructions and as shown on the drawings or specified. Fixtures damaged in transit and storage prior to completion shall be replaced at Contractor's expense.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect. The Architectural reflected ceiling plan will take precedence over electrical plans.
- D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.
- E. Lighting Fixture Supports:
 1. Contractor shall provide support for all of the fixtures independent of suspended ceilings. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Shall maintain the fixture positions after cleaning and relamping.
 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 4. Hardware for recessed fluorescent fixtures:
 5. Fixtures shall be supported as detailed on drawings and as required by DSA standards.
 6. Installation: Fixtures shall be securely mounted on ceilings and walls with appropriate fastening devices. "Lay-in" type T-bar fixtures shall be secured with #12 gauge safety

"earthquake wires" as described by California Code of Regulations Title 24 Part 2, Chapter 47. "Tech screws" will be required for fastening to the T-bar system in addition to safety wire. Surface mounted fluorescent fixtures shall be solidly screwed or clipped into framing above drywall with 4-#10 sheet metal screws into each fixture. Provide steel framing for screw supports behind all surface mounted lighting fixtures weighing more than 15 lbs.

7. Surface mounted lighting fixtures:
 - a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts shall be minimum ¼-20 bolt, secured to structural ceiling. Non-turning studs may be attached to the building structure by 12 gauge safety hangers.
 8. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
 9. Single or double pendent mounted lighting fixtures:
 - a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure and be allowed to swing to a 45 degree angle.
 10. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- F. Furnish and install the specified lamps for all lighting fixtures as part of this project.
- G. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- H. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- I. At completion of project, replace all fixtures which have failed. Clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.
- J. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION

SECTION 26 5670

LIGHTING ACCEPTANCE TESTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. A Certificate of Acceptance will be required to be filed (by the Contractor) with and approved by the enforcement agency prior to receiving a final occupancy permit. The Certificate of Acceptance will indicate that the Contractor has demonstrated acceptance requirements of the plans and specifications, that current requirements for installation certificates are met, and that currently required operating and maintenance information (as well as the Certificate of Acceptance) were provided to the building Owner.
 - 2. Testing, evaluation and calibration of lighting controls equipment provided, installed and connected in Division 26.
 - 3. Documentation of test results, completion of "Certificate of Acceptance" and "Certificate of Installation" forms and filing with the enforcement agency for approval.
 - 4. Specific Jobsite Conditions:
 - a. Acceptance testing must be tailored for each specific design, job site, and climactic conditions. While the steps for conducting each test remain consistent, the application of the tests to a particular site may vary. The Contractor shall review the construction documents and include all required time, material, testing equipment, etc. as required to complete the requirements of this section.
- B. Related Work:
 - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 5100, INTERIOR LIGHTING.
 - 3. Section 26 5600, EXTERIOR LIGHTING.

1.03 REFERENCES

- A. Acceptance Testing Criteria: 2022 Building Energy Efficiency Standards Non-Residential Compliance Manual.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements:

1. All material, equipment, labor and technical supervision to perform tests, calibrations and documentation specified herein.
- B. Scope of Testing, Evaluation and Calibration (as applicable):
 1. Automatic (master) time switches.
 2. Occupancy sensors.
 3. Automatic daylighting controls.
 4. Photo electric sensors.
 5. Daylighting controls.
 6. Outdoor astronomical time switches.
 7. Area controls.

1.05 SUBMITTALS

- A. Test Reports:
 1. Written record of all tests and completion of forms included in this section.
 2. At completion of project, assemble a final test report. Submit report to the enforcement agency and the Owner prior to final occupancy to include:
 - a. Summary of project.
 - b. Description of systems and equipment tested.
 - c. Visual inspection report.
 - d. Description of tests.
 - e. Test results.
 - f. Conclusions and recommendations.
 3. Report shall be bound in booklet form, include on the Contractor's letterhead the title of the report and the systems tested.
- B. Constructability Plan Review
 1. The Contractor shall review the construction drawings and specifications to understand the scope of the acceptance tests and raise critical issues that might affect the success of the acceptance tests prior to starting construction. Any constructability issues associated with the lighting system should be forwarded to the design team for review/modifications prior to equipment procurement and installation. The Contractor shall submit on company letterhead, with the lighting control equipment required by Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL, 1.4B, a letter confirming that the constructability review has been completed and their company has reviewed and is prepared to complete the lighting acceptance testing required by this section. The lighting acceptance testing shall be included in this letter at the time of equipment submittals.

PART 2 - PRODUCTS

2.01 FORMS

- A. Lighting acceptance testing forms and verification procedures for lighting systems that require acceptance testing can be downloaded from the following website: <http://www.energy.ca.gov>.

- B. These completed forms will be the deliverable product to the enforcement agency and Owner as described in 1.4 of this section.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Contractor's Responsibilities:
 - a. Perform all required tests required by this section.
 - b. Schedule testing with building Owner.
 - c. Provide window/skylight masking material required to simulate dark conditions of test during evening hours.
 - d. Calibration of equipment such as light meters, photo electric controls, etc.
 - e. Programming of time switches (interior/exterior lighting) for operations as directed by the Owner.

3.02 ADJUSTING

- A. Final Settings: The Contractor shall be responsible for implementing all final settings and adjustments on controls equipment as required for a complete and operating system.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 7700

ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide assisted listening systems as described herein.
- B. The system shall comply with CBC Sections 11B-219 and 11B-706.

1.2 SUBMITTALS

- A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 Assisted Listening Systems

- A. Provide and install complete, CBC compliant Assisted Listening Systems as follows:
 - 1. The two Lab/Lecture rooms shall have (as a minimum):
 - a. (1) Portable system consisting of a Listen Technologies LA-346 hard suitcase-style carrying case and containing:
 - b. (1) Battery operated, belt (clip) Listen Technologies LT-84-01 FM transmitter unit with lapel microphone.
 - c. (2) Listen Technologies LR-4200 intelligent receivers.
 - d. (2) Listen Technologies LA-430 intelligent neck loops.
 - e. (1) Listen Technologies LA-277 conference microphone.
 - f. (1) Listen Technologies LA-338 table top tripod.
 - g. (1) Listen Technologies LA-423 4 port usb charger.
 - h. (4) Battery operated, belt (clip) receivers with built in ambient (environmental) microphone and single Listen Technologies LA-401 (bud-style) earphones.
 - i. The portable systems shall be stored in the Oxnard College Administration Office available for check out. Refer to Architectural specifications for signage requirements at conference rooms and assembly areas.
 - j. Provide at least one set of portable ALS components with a minimum of two neck loops.
- B. The entire system shall be of one manufacturer and shall carry a 2-year (minimum) warranty. The system shall be as manufactured by Listen Technologies Sound Corp. or engineer approved equal.

- C. The quantity of wireless headsets on-site shall satisfy the CBC requirement of 4% of the occupancy in the largest conference room and/or assembly area. Refer to architectural sheets for occupancy loads/types.

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, and servicing of the system. Provide a minimum of 2 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.
- B. Schedule training with Owner through the Architect, with at least seven days advance notice.

END OF SECTION 26 7700

SECTION 26 0000

GENERAL PROVISIONS

PART 1 - GENERAL

- A. The general contract provisions apply to this section and take precedent over this section in case of conflict.

1.01 GENERAL PROVISIONS

- A. This division supplements the applicable requirements of other divisions.

1.02 DEFINITIONS

- A. For the purposes of Division 260000, the following definitions apply:
 - 1. Provide: Furnish and install.
 - 2. Indicated: As shown on the drawings or specified herein.
 - 3. Circuit Designation: Panel designation and circuit number, i.e., LA-13.
 - 4. Approved equal: Approved by the engineer of record as equal in his sole determination.

1.03 SCOPE OF WORK

- A. The Specifications for Work of Division 260000 include, but are not limited to the following sections:
 - 26 0000–General Provisions
 - 26 0050–Basic Electrical Materials and Methods
 - 26 0111–Conduits
 - 26 0120–Conductors
 - 26 0130–Electrical Boxes
 - 26 0190–Support Devices
 - 26 4721–Fire Alarm and Detection System
- B. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this division, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all divisions for related work required to be included as work under this division.

GENERAL PROVISIONS
26 0000-1

- 2. General provisions for electrical work.
 - 3. Site observation including existing conditions.
- C. Related Work Specified Elsewhere but included in the scope of work:
 - 1. Fire Alarm
- D. Work Not In Contract (N.I.C.):
 - 1. Telephone instruments.
- E. Coordination
 - 1. Provisions of Division 1 - General Requirements shall remain in effect.

1.04 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI).
- B. Association of Edison Illuminating Companies (AEIC).
- C. Electrical Testing Laboratories (ETL).
- D. Illuminating Engineering Society (IES).
- E. Institute of Electrical and Electronic Engineers (IEEE).
- F. Insulated Cable Engineers Association (ICEA).
- G. National Electrical Manufacturers Association (NEMA).
- H. National Fire Protection Association (NFPA).
- I. Underwriters Laboratories, Inc. (UL).
- J. California State Fire Marshal (CSFM).
- K. California Energy Commission (CEC) Title 24.

1.05 QUALITY ASSURANCE

- A. Regulations: All the electrical equipment and materials, including their installations, shall conform to the following applicable latest codes and standards:
 - 1. California Electric Code, Latest Adopted Edition (CEC), 2023 unless a more current version has been adopted.
 - 2. Local and State Fire Marshal.
 - 3. Occupational Safety and Health Act (OSHA).
 - 5. State Codes Amendments.
 - 6. Requirements of the Division of California State Architect (DSA).
 - 7. California Administrative Code, Title 8, Chapter 4, Industrial Safety Orders.
 - 8. California Administrative Code, Title 24.
- B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply. In instances where plans and specifications are at variance or conflict the most restrictive requirement shall apply. Contractor shall be responsible for all his associated work and materials and also the work and materials of related or affected trades.
- C. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, and pay for all taxes, fees and utility charges required for the electrical work.
- D. Testing and Adjustment:
 - 1. Perform all necessary tests required to ascertain that the fire alarm system has been properly installed, that the power supply to each item of equipment is correct, and that the system is free of grounds, ground faults, and open circuits, and such other tests and adjustments as may be required for the proper completion and operation of the electrical system. Contractor shall provide a copy of all test reports to prove these tests have been performed.

1.06 SUBMITTALS

- A. Procedure: In accord with the Submittal Section.
- B. Shop drawings: Detailed shop drawings for the following equipment:
 - 1. Fire alarm system.

2. Cabling and conductors
 3. Contactors and cabinet.
 4. Low voltage cabling riser diagram
- C. Product data: Detailed manufacturer's data for:
1. Fire alarm system
- D. Test results for the following:
1. Fire alarm system.
 2. Cables.
- E. Include sufficient information to indicate complete compliance with Contract Documents. Include illustrations, catalog cuts, installation instructions, drawings, and certifications. On each sheet show manufacturer's name or trademark.
- F. Operating, maintenance, and instruction data for:
1. Fire Alarm
- G. Instruction materials:
1. Provide at the time of personnel instruction period three bound copies of instruction manuals for the systems as listed in Subparagraph 1.04.A.4.f.
 2. Include the following (minimum) information in each copy of instruction manual:
 - a. Manufacturers' names and addresses including phone numbers.
 - b. Serial numbers of items furnished.
 - c. Catalog cuts, exploded views and brochures, complete with technical and performance data for all equipment, marked to indicate actual items furnished and intended use.
 - d. Recommended spare parts.

1.07 OWNER'S PERSONNEL INSTRUCTIONS

- A. Prior to completion of the contract, and at the Owner's convenience, instruct verbally and demonstrate to the Owner's personnel, the operation of the systems

as listed under operating, maintenance, and instructional data and/or emergency generator, automatic transfer switch and fire alarm annunciator panel.

1.08 CLEANING

- A. Clean exterior surfaces and interiors of equipment and remove all dirt, cement, plaster and other debris. Protect interior of equipment from dirt during construction and clean thoroughly before energizing.
- B. Clean out cracks, corners and surfaces on equipment to be painted. Remove grease and oil spots so that paint may be applied without further preparation.

1.09 PROJECT RECORD DOCUMENTS - Prepare the following and submit to the engineer before final acceptance:

- A. Mark Project Record Documents daily to indicate all changes made in the field.
 - 1. In addition to general requirements of Project Record Drawings, indicate on drawings, changes of equipment locations and ratings, alterations in raceway runs and sizes, changes in wire sizes, circuit designations, installation details, riser diagrams, control diagrams and schedules.
- B. Use green to indicate deletions and red to indicate additions.
 - 1. Use the same symbols and follow the same drafting procedures used on the Contract Drawings.
- C. Locate dimensionally off of contract drawings all underground conduit stubbed-out for future use, underground feeder conduits, and feeder pull box locations using building lines by indicating on the Project Record Drawings.
- D. At the completion of underground conduit installation provide underground conduit record documents to owner's representative.
- E. Two copies, in binder form, of all test results as required by these specifications -
- F. Two copies of local and/or state code enforcing authorities final inspection certificates.
- G. Two copies, in binder form, of electrical equipment cut sheets, manufacturer's installation instructions, warranty certificates, and product literature for all products utilized on project.

1.10 SERVICE INTERRUPTIONS AND UTILITY

- A. Coordinate with the Owner the interruption of services necessary to accomplish the work.
 - B. Coordinate with the PM all work associated with power and communications distribution systems and service entrance equipment.
 - C. Electrical contractor shall supply temporary power for all trades.
- 1.11 MINIMUM SPECIFICATION REQUIREMENTS (ALL WORK OF DIVISION 260000)
- A. As a minimum Specification requirement, all materials and methods shall comply with applicable governing codes.
- 1.12 PENETRATION SEALING 
- A. Seal penetration through exterior walls and fire rated walls, floors, ceilings, and roofs with 3M Firestopping materials of fire rating capacity rated per architectural plans and CBC and DSA or prevailing building code requirements.
- 1.13 PLACING EQUIPMENT IN SERVICE
- A. Do not energize or place electrical equipment in service until all interested parties have been duly notified and are present or have waived their rights to be present. Where equipment to be placed in service involves service or connection from another contractor of the owner, notify the owner in writing when the equipment will be ready for final testing/connection and schedule to the owner's satisfaction of this service connection. Notify the owner two weeks in advance of the date the various items of equipment will be complete.
- 1.14 OWNER-FURNISHED ITEMS
- A. Pick up Owner-furnished items and handle, deliver, install, and make all final connections.
 - 1. Assume responsibility for the items when consigned at the storage facility or in the field in accord with requirements of the Contract Documents.
- 1.15 ELECTRIC ITEM LOCATION
- A. Electrical drawings are generally diagrammatic. Verify equipment sizes with shop drawings and manufacturers' data and coordinate location layout with other trades. Notify owner and engineer of any changes of location requirements prior to installation and obtain engineer's written acceptance for all changes/revisions.

1.16 DEMOLITION

- A. Scope: Provide and perform demolition, preparatory and miscellaneous work as indicated and specified, complete.
- B. Principle Items of Work:
 - 1. Demolition and removal of existing electrical conduit, wiring and equipment required to complete the project.
 - 2. Preparation of the existing building to receive or connect the new work.
 - 3. Miscellaneous demolition, cutting, alteration, and repair work in and around the existing building necessary for the completion of the entire project.
 - 4. Disconnecting and reconnection of electrical equipment as required by the construction modifications.
- C. Existing Conditions: Make a detailed survey of the existing conditions pertaining to the work. Check the locations of all existing structures, equipment and wiring (branch circuiting and controls). Provide at bid time any exclusions for existing conditions work.
- D. Salvage and Disposal: All removed material other than items to be reused shall be returned to the owner or disposed of in accordance with instructions from the owner's representative. Disposal shall be done in accordance with EPA and governing body requirements and regulations. Contractor shall pay all fees and charges for disposal.

1.17 ELECTRICAL WORKMANSHIP REQUIREMENTS

- A. It is required that all electrical construction of this Contract be performed by journeyman electricians. All journeyman electricians shall have a minimum of 4 years of apprenticeship training and hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards. This is intended to mean that a person who does not hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards will not be permitted to do electrical work of any kind that involves new construction, nor make repairs, alterations, additions, or changes of any kind to any existing system of electrical wiring, apparatus, equipment, light, heat, or power.

- B. Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under direct and constant personal supervision of a journeyman electrician holding a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.
 - 1. Each journeyman electrician will be permitted to be responsible for quality of workmanship for a maximum of eight helpers or apprentices during any same time period, provided the nature of work is such that good supervision can be maintained and quality of workmanship achieved is the best, as expected by Owner and as implied by the latest edition of the California Electrical Code (National Electrical Code with State of California amendments).
 - 2. Before each journeyman electrician commences work, deliver to Owner at project site a photocopy of journeyman's valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.
- C. All electrical systems shall be installed in a neat and workmanlike manner per National Electrical Code requirements and ANSI approved NEIS National Electrical Installation Standards.

1.18 DESIGN CHANGES AFTER AWARD OF BID

- A. When a change in the quantity or size of conductors is made, the conduit size will remain in accordance with that indicated in the original contract drawings rather than the drawing symbol conduit table. When code permits, provide conductor insulation 'THWN' where required to maintain conduit fill conformance with the National Electrical Code.

1.19 MATERIAL AND EQUIPMENT SUBSTITUTION

- A. Where two or more trade names or manufacturers are mentioned, selection shall be made from the group listed for use in the base bid. The order in which names are listed is not intended to be any indication of preference.
- B. Where a single manufacturer, product or trade name is stated, that manufacturer, product or trade name shall be used in the base bid. The use of other manufacturers, products or trade names will be considered by the engineer of record (unless that product is indicated for no substitution) only if submitted as alternate items at the time of bidding, with evidence of equality and a statement of net price difference as compared to the specified item. After approval by the

engineer of record, the architect and owner reserve the right to review such submittals and to determine the acceptability for use.

- C. Equipment other than that specified will be accepted only when written approval is given by the engineer of record and architect, in accordance with Division 1.
- D. The contractor shall be held responsible for all physical changes in piping, equipment, etc. resulting from equipment substitution and likewise bear any increased cost of other trades in making said substitution. Approval by the architect of equipment other than that specified does not relieve this contractor of this responsibility.

1.20 REQUESTS FOR INFORMATION

- A. The contractor shall submit all requests for information (RFI's) typewritten on the attached form.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

BLANK PAGE

SECTION 26 0050
BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

- 1.01 DESCRIPTION: Division 1 applies to this Section. This Section contains general requirements for the Sections in Division 26.
- A. Related Work Not in Division 26: Refer to individual Division 26 Sections.
- 1.02 QUALITY ASSURANCE:
- A. Codes: Entire installation shall comply with requirements of authorities having jurisdiction.
- B. Permits: Contractor shall pay for all permits required by work under this Division.
- C. Inspections: Contractor shall arrange for all inspections and correct non-complying installations.
- 1.03 SUBMITTALS: Refer to Division 1 for procedures.
- A. Material and Equipment: Prior to start of work, 6 copies of a list of all materials and equipment covered by Division 26 shall be submitted for approval. Contractor shall allow ample time for checking and processing and shall assume responsibility for delays incurred due to rejected items. No installation of material concerned shall be made until such written approval has been obtained. Approval of materials and equipment shall in no way obviate compliance with the Contract Documents. Each item proposed shall be referenced to the applicable Section, Page, and Paragraph of Division 26. For each item proposed, give name of manufacturer, trade name, catalog data, and performance data.
- B. Equipment Layout Drawings: Submit "Equipment Layout Drawings" for each equipment room or area containing equipment items furnished under this Division. Layout Drawings shall consist of plan view of room, to scale, showing projected outlines of all equipment, complete with dotted line indication of all required clearances including all those needed for removal or service. Location of all conduit and pull boxes shall be indicated.
- C. Service Manuals: Refer to Submittal Section. Indexed Service Manuals shall be submitted which shall include test reports, service instructions, and renewal parts lists of all equipment.
1. Submission and Information: Service Manuals shall be submitted for approval at least 30 days before final inspection. The following information together with any pertinent data, shall be included in Service Manual:
- a. Renewal part numbers of all replaceable items.

BASIC ELECTRICAL MATERIALS & METHODS
26 0050-1

- b. Manufacturer's cuts and rating data.
 - c. Serial numbers of all principal pieces of equipment.
 - d. Supplier's name, address, and phone number.
 - e. Final settings for all breakers, relays, and control devices (See Section 26032).
- 2. Copies: Four (4) copies of approved Service Manual shall be delivered on or before date required.
- D. Record Drawings: Prepare and submit in accordance with requirements. Contractor shall make notations, neat and legible, daily as the work proceeds. Drawings shall be available for inspection at all times and kept at the job site. All buried conduit and/or indicated future connections outside any building shall be located both by depth and by accurate measurement from a permanently established landmark such as a building or structure.
- E. Seismic Calculation: Refer to Article 3.01 herein.
- F. Spare Parts: Conform to the Submittal Section. Deliver following spare parts to Owner and obtain receipts. Submit at same time as Operating Instructions:
 - 1. Spare fuses; 1 set for each combination fuse breaker.
 - 2. Spare pilot light lamps of each type used on project, in quantity of 10%, but not less than 2%.
 - 3. Overload heater elements; 2 sets for each size used on project.
- G. Special Tools: If any part of the equipment furnished under Division 26 requires a special tool for assembly, adjustment, resetting, or maintenance thereof and such tool is not readily available on the commercial tool market, it shall be furnished with the equipment as a standard accessory and delivered to the Owner.
- H. Maintenance Paint: One (1) can of touch-up paint shall be delivered to Owner for each different color factory finish which is to be the final finished surfaces of the product.

1.04 DRAWINGS:

- A. Diagrammatic Drawings: For purposes of clarity and legibility, drawings are essentially diagrammatic although size and location of equipment is drawn to scale wherever possible, Contractor shall make use of data in all the Contract Documents and verify information at building site.
- B. Routing of Conduit and Piping: The drawings indicate required size and termination of conduits and raceways. It is not intent to indicate all necessary offsets and it shall be the responsibility under this Division to install conduit in such a manner as to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and make all equipment requiring inspection, maintenance and repair accessible without extra cost to the Owner.

- C. Coordination with Other Trades: Check with other Divisions of the Specifications so that no interference shall occur and in order that elevations may be established for the work. Installed work which interferes with the work of other trades shall be removed and rerouted at the discretion of the Architect.

1.05 DAMAGE AND REPAIRS:

- A. Emergency Repairs: Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding Contractor's warranty or relieving Contractor of his responsibility during warranty period.
- B. Responsibility for Damage: Contractor shall be responsible for damage to grounds, buildings, or equipment due to work furnished or installed under this Division 26.

1.06 PROTECTION, CARE, AND CLEANING:

- A. Protection: Provide adequate protection for finished parts of materials and equipment against physical damage from any cause during progress of work and until final completion. Sensitive electrical equipment shall not be installed until major construction is completed.
- B. Care: During entire construction, properly cap all lines and equipment to prevent entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or work of other trades by covering with polyethylene sheets.
- C. Cleaning: After installation is completed, clean all systems as follows in addition to requirements specified:
 - 1. Field Painted Items: Clean exterior of conduits, raceways, piping and equipment exposed in completed structure; removing all rust, plaster, cement and dirt by wire brushing. Remove grease oil and similar materials by wiping with clean rags and suitable solvents.
 - 2. Factory Finished Items: Remove grease and oil on all factory finished items such as cabinets and controllers, and leave surfaces clean and polished.
- D. Connection: Prior to energizing, check all electrical connection hardware and torque where necessary.

PART 2 - PRODUCTS

- 2.01 PRODUCTS: Products and materials shall be as specified in the pertinent Sections of Division 26.
- 2.02 MATERIALS AND EQUIPMENT: Wherever possible, all materials and equipment used in installation of this work shall be of same manufacturer throughout for each class of material or equipment. Materials shall be new and bear UL label, wherever subject to such approval. Comply with ANSI, IEEE and NEMA standards, where applicable.

PART 3 - EXECUTION

- 3.01 SEISMIC REQUIREMENTS: Electrical equipment for emergency systems shall be braced to withstand the lateral forces that result from earthquakes. Per contract documents detail on electrical and structural plans, install equipment as noted on these documents.
- 3.02 GENERAL LATERAL BRACING REQUIREMENTS: As shown on Drawings. Additional bracing requirements shall conform to specific requirements shown on Drawings or in other Sections of Division 26. Anchorages for equipment subject to thermal expansion and movement shall conform to manufacturer's recommendation and intent of general bracing requirements. When general and specific bracing requirements enumerated above are in conflict with referenced standards, the most stringent requirements shall govern.
- 3.03 EXCAVATION AND BACKFILL: Perform all excavation and back fill required to install Work of Division 26, both inside and outside. Perform all excavation and backfilling in accordance with Division 2.
- A. Excavation: Bury conduits outside building to a depth of not less than 24" (or as required by Code) below finish grade, unless noted otherwise.
 - B. Backfilling: Do not backfill until after final inspection and approval of conduit installation by all legally constituted authorities and recording of the buried items on the Record Drawings.
- 3.04 CUTTING AND PATCHING:
- A. Cutting of Existing Structural Work: Holes in existing slabs and concrete walls shall be cored to the minimum size required. The Contractor shall submit Drawings showing dimensioned sizes and locations for all such holes to Architect for approval before cutting. Where required for conduit installation, slabs on grade shall be saw-cut to minimum required width; submit cutting Drawings to the Architect for approval before cutting.
 - B. Patching: Holes or chases shall be patched to match adjacent surfaces.
- 3.05 CONCRETE WORK: Concrete construction required for the Work of Division 26 shall be provided under the Work of Division 26.
- 3.06 PAINTING: Finish painting of electrical equipment will be as specified in Division 9, unless equipment is herein specified to be furnished with factory applied finish coats. Equipment to be field painted shall be furnished with a factory applied prime coat.
- A. Touch-Up: If factory finish on any equipment furnished under Division 26 is damaged in shipment or during construction of building, the equipment shall be refinished by Contractor to satisfaction of Architect.

- B. Concealed Equipment: Uncoated cast-iron or steel that will be concealed, or will not be accessible when installations are completed, shall be given one heavy coat of black asphaltum before installation.
- 3.07 OPERATING INSTRUCTIONS: Contractor to provide services of an experienced Engineer to instruct Owner in operation of entire installation. Instructional period shall be during normal work day hours. This instruction period may be simultaneous with compliance tests.
- 3.08 COMPLIANCE TESTS: Conduct such tests of all portions of installation as may be necessary to ensure full compliance with the Drawings and Specifications. Tests shall be made in the presence of the Owner. Costs of test shall be borne by Contractor and Contractor shall provide all instruments, equipment, labor and materials to complete all the tests. Tests may be required on any item between installation of Work and the end of 1 year warranty period. Should these tests develop any defective materials, poor workmanship or variance with requirements of Specifications, Contractor shall make any changes necessary and remedy any defects at his expense.
- A. All Feeders: Measure and record as follows:
1. 600 volt conductors shall be tested with 500 volt megger to ground on each phase. megger to be on test for one minute before any readings are taken. The minimum values on all feeders shall be 100,000 OHMS.
 2. Copies of the certified test readings shall be transmitted to Owner.
- 3.09 SYSTEM ACCEPTANCE:
- A. Final Review: The Contractor shall request a final review prior to system acceptance after:
1. Completion of installation of all systems required under the Contract Documents.
 2. Submission and acceptance of operating and maintenance data.
 3. Completion of identification program.
- B. Acceptance: Is contingent on:
1. Completion of final review and correction of all deficiencies.
 2. Satisfactory completion of acceptance tests demonstrating compliance with all performance and technical requirements of Contract Documents.
 3. Satisfactory completion of training program and submission of manuals and Drawings required by Contract Documents.
- 3.10 PRELIMINARY OPERATION: The Owner reserves the right to operate portions of the electrical system on a preliminary basis without voiding the warranty or relieving the Contractor of his responsibilities.

3.11 CLEAN-UP: Conform to the Submittal Section. Upon completion and at other times during progress or Work, when required, remove all surplus materials, rubbish, and debris resulting from Work of Division 26.

END OF SECTION

SECTION 26 0111

CONDUITS

PART 1 - GENERAL

- A. The general provisions apply to this section.

1.01 WORK INCLUDED

- A. Conduits; including:
 - 1. Rigid steel conduit.
 - 2. Intermediate metal conduit (IMC).
 - 3. Electrical metallic tubing (EMT).
 - 4. Rigid aluminum conduit.
 - 5. Polyvinyl chloride conduit (PVC).
 - 6. Flexible metal conduit.
 - 7. Liquid-tight flexible metal conduit.

1.02 DEFINITION

- A. Conduit: This term shall be construed to mean conduit and conduit fittings; and tubing and tubing fittings.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Support material:

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION - ALL MATERIALS SHALL BE MANUFACTURED IN THE USA.

- A. Rigid Steel Conduit: Hot-dipped galvanized or sherardized including the threads, manufactured in accordance with ANSI C80.1 and UL6.
 - 1. Threaded, hot-dipped galvanized or sherardized fittings manufactured in accordance with ANSI C80.4.

CONDUITS
26 0111-1

- B. Intermediate Metal Conduit: Hot-dipped galvanized including the threads, manufactured in accordance with UL 1242.
- C. Electrical Metallic Tubing: Manufactured in accordance with ANSI C80.3 and UL 797.
 - 1. Provide compression fittings in walls, ceiling spaces or exposed construction areas.
 - 2. Provide compression (water tight) fittings in damp areas or areas exposed to weather.
- D. Rigid Aluminum Conduit: not to be used
- E. Polyvinyl Chloride Conduit: Schedule 40 and schedule 80, manufactured in accordance with ANSI C33.91, UL 651, and Nema TC-2.
 - 1. Cemented type fittings of the same manufacturer as the conduit.
- F. Polyvinyl Chloride Conduit: Type EB, not to be used.
- G. Flexible Metal Conduit: Hot-dipped galvanized steel, manufacturer in accordance with UL 1.
 - 1. Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all sizes and twist-in connectors for 3/4-inch flexible metal conduit.
- H. Liquid-Tight Flexible Conduit: Hot-dipped galvanized with liquid-tight vinyl jacket.
 - 1. Liquid-tight fittings.

PART 3 - EXECUTION

3.01 USE

- A. EMT for all exposed and concealed work except as indicated in Paragraphs B, C, D, E, F, and G.
- B. Rigid steel, IMC, or rigid aluminum conduit in areas where exposed conduit could be subject to physical damage or where conduit is exposed and conductor phase to ground voltage exceeds 300 volts.
- C. Rigid aluminum conduit may not be used for all feeder runs exposed or concealed in stud walls and spaces above suspended ceilings.
- D. PVC Conduit:

CONDUITS
26 0111-2

1. Schedule 40 for runs below grade in direct contact with earth.
 2. Schedule 40 in concrete floors, walls or roofs.
 3. Schedule 80 in exposed areas subject to damage
 4. Schedule 80 when exposed to UV
- E. Flexible Conduit (steel only permitted):
1. For connection to equipment subject to vibration, maximum length 18 inches. In wet locations use liquid-tight flexible conduit.
 2. For connection to lighting fixtures above suspended ceilings. Lengths limited to 72 inches.
 3. Install ground conductors in all flexible conduits.
- F. Where 3/4-inch conduit runs are concealed in walls or ceilings and these runs are through wood studs and wood joists, flexible steel conduit may be used up to a maximum length of 6'0".
- G. All risers shall be PVC coated RGS with bushings.
- H. In concrete or below grade use conduit not smaller than 1 inch. Maximum size in concrete slab: 1 inch. Run larger sizes under slab.
- I. Use long sweep elbows with minimum radius 10 times nominal conduit diameter for all telephone and communication runs.

3.02 INSTALLATION

- A. Provide conduit support and bracing in accordance with the latest published SMACNA guidelines.
- B. Perform excavating, trenching, backfilling, and compacting as specified in Division 2.
- C. Minimum cover for runs below finished grade outside buildings: 24 inches except where noted. Minimum cover for conduit in concrete floors, walls or roof: 1/3 thickness of slab. Minimum cover under building slabs is 12-inches.
- D. Minimum separation from uninsulated hot water pipes, steam pipes, heater flues or vents: 6 inches. Avoid running conduits directly under water lines.
- E. Protect inside of conduit from dirt and rubbish during construction by capping all openings with plastic caps intended for the purpose.

CONDUITS
26 0111-3

- F. Provide conduit bodies for exposed conduit runs at junctions, bends or offsets where required. Do not use elbows or bends around outside corners of beams, walls or equipment. Make conduit body covers accessible.
- G. Make conduit field cuts square with saw and ream out to full size. Shoulder conduits in couplings.
- H. Make conduit projections from covered areas to areas exposed to the weather watertight by proper flashing. Extend flashing a minimum of 6 inches in all directions from conduit.
- I. Where conduit is to remain empty, install polypropylene or nylon pull-line 3/16" minimum diameter from end to end with tag at each end designating opposite terminations.
- J. Run conduit parallel and at right angle to building lines, when visible in finished construction.
- K. Cap conduits indicated to be stubbed-out underground using glued-on PVC caps intended for this purpose.
- L. Install a coupling flush with the floor on all conduits stubbed up through floors on grade.
- M. Make no bends with a radius less than 12 times the diameter of the cable it contains nor more than 90 degrees. Make field bends with tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.
- N. Where conduit installed in concrete or masonry extends across building construction joints, provide expansion fittings as manufactured by O.Z.; Crouse-Hinds; Appleton; or equal, with approved ground straps and clamps.
- O. Concrete Wall or Slab Penetrations: All core drilling, sleeves, blockouts or other penetrations must be approved by the Structural Engineer prior to installation.
 - 1. Space sleeves and core drills to insure a minimum dimension of 3 times the nominal trade diameter of the largest adjacent conduit between sleeves or core drills.
 - 2. Use blockouts for concentrations of conduits in a confined area.
- P. Do not penetrate walls with flexible conduit where subject to physical damage. Use recessed box with extension ring for transition from interior to exterior of wall.
- Q. All homeruns shown shall be run to the panel indicated independently of all other homeruns. Provide pull points so as not to exceed total bends of 360 degrees between them unless otherwise indicated.

CONDUITS
26 0111-4

- R. At switchboards, manholes and floor standing distribution panelboards, provide insulated throat bushings or bell ends on all non-metallic conduit entries and bushings on all metallic conduit entries.
- S. Provide bushings on all conduit terminations sized 1" and larger.
- T. Provide weatherproof boxes and connectors for all exposed parking structure raceways and boxes.
- U. Provide bell ends on all conduits into pullboxes and manholes, seal all conduits after conductors are pulled.
- V. Cap all unused conduits with end cap. Do not tape.
- W. All Fire Alarm Conduits shall be painted red except in exposed ceiling areas.

END OF SECTION

BLANK PAGE

SECTION 26 0120

CONDUCTORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Conductors; for power, lighting, sound, communication and control, including conductors for general wiring, flexible cords and cables, and ground conductors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Section 260000.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

- A. Conductors for General Wiring: Thermoplastic insulated rated for 600V manufactured in accordance with UL 83.
 - 1. Provide 3/4 hard drawn copper conductors. Provide solid conductor for #12 AWG and smaller. Provide stranded conductors for #10 AWG and larger.
 - B. Conductor Connectors for General Wiring:
 - 1. Sizes No. 14 to No. 8: Splice with insulated spring wire connectors.
 - a. Ideal No. 451, 455 and 453.
 - b. Minnesota Mining: Types Y, R, G, and B.
 - c. Buchanan No. B1, B2 and B4.
 - 2. Size No. 6 or Larger, Copper: Splice and terminate with compression or pressure type connectors and terminal lugs.
 - C. Provide connector sealing packs for all area and exterior box splices which require complete protection from dampness and water.
 - 1. Scotchlok No.'s 3576, 3577 and 3578, by 3M Company.
- 2.02 Cabling – provide Fire Alarm cabling as noted on the drawings. Provide AQ type aqua seal cables for all underground cabling.

CONDUCTORS

26 0120-1

PART 3 - EXECUTION

3.01 USE

A. Conductors for General Wiring:

1. Minimum 75 degrees C temperature rated insulation on conductors, except use minimum 90 degrees C temperature rated insulation on conductors in conduits exposed on roof, or where required due to ambient temperature.
2. Stranded conductors at motors, audio video and other applications where subject to vibration.
3. Minimum size conductors for power and lighting #12 AWG, except where noted.
4. Minimum size conductors for control circuits #14 AWG stranded with THHN/THWN insulation.

B. Use flexible cords and cables for connection of special equipment as indicated. Length not to exceed 72 inches.

C. Ground Conductors:

1. Provide an insulated green ground conductor for all branch circuit wiring where indicated.
2. Bare copper conductor may be used.
 - a. Install ground conductors in all non-metallic conduits as required by code. Install ground conductors in all motor branch circuits and all feeders. Where ground conductor size is not indicated, provide size as required for an equipment ground conductor by the National Electrical Code.
 - b. Install ground conductors in all flexible metal conduits.

D. Install XHHW – 2, 90°C copper conductors for all underground installations unless noted otherwise on the plans.

E. Install for all dimmers, stranded THHN/THWN – 2 copper 90°C conductors with dedicated neutrals.

3.02 INSPECTION

A. Check conduit system for damage and loose connections, replace damaged sections.

CONDUCTORS

26 0120-2

- B. Check for caps at conduit openings. Make sure that inside of conduit is free of dirt and moisture.
- C. Pull mandrel, one size smaller than the conduit, through entire length of all underground conduits prior to conductor installation.

3.03 INSTALLATION

A. Conductors for General Wiring:

1. Color code conductors insulation as follows:

CONDUCTOR	SYSTEM 208Y/120	VOLTAGE 480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow

2. For conductors #6 AWG or larger, permanent plastic colored tape may be used to mark conductor in lieu of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.
 - a. Provide color tape on each end and at all terminal points and splices on wire enclosed in conduit.
 - b. Provide color tape every 3 feet on wire not enclosed in a listed wireway.
 3. When pulling conductors, do not exceed manufacturer's recommended values.
 4. Use polypropylene or nylon ropes for pulling conductors.
- B. Insulate splices with plastic electrical tape: Scotch No. 33+, Tomic No. 1T, or equal.
 - C. Terminate all control wires with terminal lugs on terminal boards not designed with pressure plates. If splices are needed, use same procedure, installing a terminal board in a junction box for protection.
 - D. All splices or connections shall be compression type Thomas & Betts or Burndy, no split bolt connections are allowed.

3.04 IDENTIFICATION

- A. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices and in pull boxes.

- B. Branch Circuits: Identify with the corresponding circuit designation at the over-current device and at all splices and devices.
- C. Control Wires: Identify with the indicated number and/or letter designation at all terminal points and connections.
- D. Alarm and Detection Wires: Identify with the indicated wire and zone numbers at all connections, terminal points, and coiled conductors within cabinets.
- E. Conductors Terminated By Others: Indicate location of opposite end of conductor, i.e., Pull Box-Room 101.
- F. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Permasleeve with type written identification.
- G. Circuit designation is construed to mean panel designation and circuit number, i.e., LA-13.

END OF SECTION

CONDUCTORS

26 0120-4

SECTION 26 0130
ELECTRICAL BOXES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Boxes; including:
 - 1. Outlet boxes.
 - 2. Pull and junction boxes.
 - 3. Cabinets.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Section 260000.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

- A. Outlet Boxes:
 - 1. Pressed Steel Boxes: Knockout type, hot-dipped or electro-plate galvanized.
 - 2. Cast Iron Boxes: Hot-dipped or electro-plate galvanized with threaded hubs.
 - 3. Cast Iron Conduit Bodies: Hot-dipped or electro-plate galvanized with threaded hubs.
 - 4. Cast copper free aluminum conduit bodies with threaded hubs.
 - 5. Covers for Pressed Steel Boxes: Hot dipped or electro-plate galvanized.
 - 6. Outlet boxes manufactured in accordance with UL 514.
- B. Pull and Junction Boxes:
 - 1. Sheet steel, hot-dipped or electro-plate galvanized, or prime coated and a final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.

ELECTRICAL BOXES
26 0130-1

- a. Where exposed to weather, provide raintight hubs for conduits entering the boxes, top and sides only.
- 2. Floor Boxes:
 - a. Single gang, similar to Hubbell #B-2536.
 - b. Covers:
 - 1) Combination, similar to Hubbell #S-2525.
 - 2) Duplex receptacle, similar to Hubbell #S-3925.
 - c. Carpet flange, similar to Hubbell #S-3075 thru #S-3079.
 - d. Hubs: Provide hubs as required to suit the conduit arrangement.
- 3. Pre-Cast Concrete Pull Boxes: As manufactured by Jensen Pre-Cast or Utility Vault and shown on drawings.
- 4. High impact resistant PVC boxes: As manufactured by Carlon, Sedco, or R & G Sloan.
- C. Cabinets: Sheet metal, prime coat and final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.
 - 1. Control Cabinet: NEMA 1 enclosure, door with butt hinges and flush handle latches.
 - a. Provide with removable steel back panel.
 - 2. Terminal Cabinets: NEMA 1 enclosure, door with concealed hinges and spring catch type flush cylinder locks. Key locks alike, provide two keys with each lock.
 - 3. Provide engraved plastic nameplates with 1/2" minimum height letters indicating designation of control and terminal cabinets as shown on the drawings.
 - a. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

PART 3 - EXECUTION

3.01 USE

A. Outlet Boxes:

ELECTRICAL BOXES
26 0130-2

1. Ceiling Outlet Boxes: Not less than 4" octagonal by 2" deep.
2. FDD cast iron or cast aluminum device boxes and conduit bodies with metal covers for exposed conduit installation. Provide gasket for covers in wet areas.
3. Intercom, Microphone and TV Outlet Boxes: Not less than 4-11/16" square x 2-1/8" deep.
4. Provide floor boxes with quantity of gangs as required for power, communication or control as indicated. Use boxes with barriers where required. Provide carpet flanges in carpeted areas.

B. Pull and Junction Boxes:

1. Use sheet steel boxes NEMA Type 1 for indoor and NEMA Type 3R for outdoor installation, except as follows.
2. Use pre-cast concrete boxes for boxes flush in finish grade where requiring a nominal capacity greater than 144 cubic inches, where located in vehicular traffic areas, or where indicated.
3. Use polyvinyl chloride (PVC) boxes flush in finish grade when the nominal internal volume is less than or equal to 144 cubic inches or where indicated.
4. Use cast iron boxes for boxes flush in slab on grade.

3.02 INSTALLATION

- A. Provide 3/8" fixture studs in wall bracket and ceiling boxes.
- B. Provide covers suitable for the fixtures or devices used.
- C. Make outlet box covers flush with finished surfaces.
- D. Close unused open knockouts with knockout seals.
- E. Provide 1" deep plaster rings on recessed outlet boxes installed in areas where concrete will be exposed after construction is complete.
- F. Where boxes are concealed in exposed concrete unit masonry, use square cornered types or boxes fitted with rings of sufficient depth for the box to be recessed completely within cavity of block or tile. Install box to insure that ring fits an opening sawed out of the masonry, so that no mortar is required to fill between ring and construction.
- G. Provide a 6" base of compacted crushed rock under pre-cast concrete pull boxes.

ELECTRICAL BOXES
26 0130-3

- H. Adjust floor boxes so they are level with top of finished floors.
- I. Provide pull boxes and junction boxes in all branch circuit and feeder runs as indicated. Do not provide pull boxes unless they are indicated or required by the Electrical Code.

3.03 IDENTIFICATION

- A. Junction Boxes: Use permanent black marker, 2" high lettering, and on each cover plate indicate the power source and circuits contained within that junction box.

END OF SECTION

SECTION 26 0190
SUPPORT DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Support devices for conduit, boxes, lighting fixtures and equipment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Hangers, Straps and Beam Clamps:
 - 1. Efcor.
 - 2. Raco, Inc.
 - 3. Steel City.
 - 4. O.Z./Gedney Co.
 - 5. Caddy Fastening System by ERICO Products Inc.
- B. Channels and Fittings:
 - 1. Kindorf.
 - 2. Unistrut Corp.
- C. Anchors:
 - 1. Acherman-Johnson Corp.
 - 2. Phillips Drill Co.
 - 3. Rawl Products Co.

2.02 MATERIAL AND FABRICATION

- A. Hangers: Steel cadmium plated.

- B. Straps: One-hole and two-hole malleable iron, hot-dipped galvanized or steel, cadmium or zinc plated.
- C. Beam Clamps: Malleable iron, hot-dipped galvanized or cadmium plated.
- D. Channels and Fittings:
 - 1. Channels: Hot-dipped galvanized.
 - 2. Fittings: Galvanized.
- E. Anchors: Self drilling and expansion bolt types. No wood or fiber plugs or concrete nails are acceptable.

PART 3 - EXECUTION

3.01 USE

- A. Use one-hole or two-hole straps for single conduit runs on walls or ceilings.
- B. Use hangers with solid steel rods for hanging single conduits.
- C. Use formed channel trapezes for groups of two or more conduits.
- D. To fasten boxes and supports to:
 - 1. Wood: Use wood screws or screw type nails of equal holding power.
 - 2. Brick and Concrete: Use bolts and expansion shields.
 - 3. Hollow Masonry Units: Use toggle bolts.
- E. Support sheet metal boxes from building structure directly or by bar hangers.
- F. Do not penetrate reinforced concrete beams with fastenings more than 1-1/2" or reinforced concrete joints with more than 3/4" fastenings to prevent contact with reinforcing steel.

END OF SECTION

SECTION 26 4721

AUTOMATIC EMERGENCY VOICE EVACUATION FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. This specification document provides the requirements for the Fire Alarm Systems throughout the facility. These systems shall include, but not be limited to, system terminal cabinets, signal power boosters, backboards, terminal strips, devices with termination, wire/cabling, testing and verification and other relevant components. The contractor shall include all costs for devices, wire, cable, panels, installation labor, tests, approvals and as-built documentation. Additionally, the contractor will be required to provide the necessary interfaces (control modules, etc.) to the monitoring system in which audio is incorporated. All conduits for the fire alarm systems and associated wiring shall be included. The fire alarm contractor shall provide “shop” drawing layouts to owner showing device locations mounting heights and conduit size requirements.

1.02 WORK INCLUDED

- A. General Requirements:
 - 1. The contractor shall furnish and install an automatic addressable fire alarm panel, handset, annunciator, signal booster panels, Manual Pull Stations, Smoke Detectors, Heat Detectors, system alarm connections, connection to building water flow, tamper and post indicator valves, Alarm Speakers, Alarm Strobes, Alarm Speakers/Strobes, outdoor Speakers as required by code and as specified herein.
 - 2. Labeling: All system equipment shall be labeled with the manufacturer's name and logotype to assure the integrity of the complete system.

1.03 RELATED WORK DOCUMENTS – REFERENCE APPLICABLE SPEC SECTIONS:

- A. Submittals.
- B. Coordination
- C. Electrical General Requirements
- D. Electrical Raceway

- E. Electrical Conduit
- F. Electrical Outlet and Junction Boxes
- G. Electrical Interior Pull boxes and wireways
- H. Systems Plans (monitoring systems)
- I. Electrical Plans

1.04 DESCRIPTION:

- A. This section of the specification includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting evac/fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of latest CBC/CFC NFPA 72 Standards for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
- C. The FACP and peripheral initiation devices shall be manufactured 100% by a single manufacturer (or division thereof).
- D. The installing company shall employ only factory-trained technicians on site to install and perform the final checkout and to ensure the systems integrity. No “parts & smarts” installation will be acceptable. Contractor to provide documentation from the Fire Alarm Manufacturer’s regional center certifying the company and the project manager are licensed by the Manufacturer to install and program the selected fire alarm equipment.

1.05 SCOPE

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.
- B. Basic Performance:
 - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on a two wire Signaling Line Circuit (SLC).
 - 2. Initiation Device Circuits (IDC) shall be a two-wire circuit.

3. Notification Appliance Circuits (NAC) shall be as manufacturers required cabling for speakers, amplifiers and related equipment as required by CBC/CFC 907.
4. Digitized electronic signals shall employ check digits or multiple polling.
5. A single ground or open on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
7. The Alarm System shall perform the following functions per CBC/CFC 907.5.2.2.2 thru 907.5.2.2.5.
 - a. Provide automatic fire alarm detection in all building spaces as dictated by local code requirements.
 - b. Provide evacuation signals as dictated by CBC/CFC 907 code requirements.
 - c. Provide visible alarms per 907.5.2.3.1 thru 907.5.2.3.4.
 - d. Provide exterior alarm notifications per CFC 907.
 - e. Perform any added functions as specified or required by local codes or AHJ.
 - f. Emergency voice/alarm communications system.

C. Basic System Functional Operation:

1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
 - a. The system alarm LED shall flash.
 - b. A local piezo electric signal in the control panel shall sound.
 - c. A backlit 80 character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

- d. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
- e. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed and the associated system outputs (alarm Notification appliances and/or relays) shall be activated.

1.06 SUBMITTALS

A. General:

- 1. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
- 2. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Software Modifications: Provide per NFPA 72, 7.5.7

- 1. Provide the services of a factory trained and certified authorized technician to perform all system software programming per NFPA 72, 7.5.7, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
- 2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modification on site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
- 3. A copy of the site specific software shall be provided to the client after completion of programming including all passwords. A copy of this program shall be stored on site in non-volatile, non-erasable, non-rewritable memory.

- C. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.
- D. Owner's designated representative shall approve all equipment submittals.
- E. In addition to the General requirements, submit all materials for approval arranged in the same order as Specifications, Individually referenced to Specification paragraph and drawing number Submit number required In Division I plus three (3) copies of A4 material and 2 prints plus one reproducible of drawings in A0, minimum. Submit A4 items bound in volumes and A0 drawings in edge bound sets.
- F. Progress Schedule: Include duration and milestones for the following:
 - 1. All submittals specified.
 - 2. Shipment to site.
 - 3. Installation.
 - 4. Field testing.
 - 5. Training.
 - 6. First beneficial use date.
- G. Manufacturer's Product Data:
 - 1. List of Materials: For each item, Include:
 - a. Manufacturer.
 - b. Model number.
 - c. Listing: CSFM.
 - d. Quantity.
 - 2. Manufacturer's Product Data: In sequence of List of Materials, Data sheet for each item, including all accessories, marked for proposed product. Photo copies will not be accepted. Original manufacturer specifications sheets only.

H. Field/Shop Drawings:

1. Resubmit: for coordination reference complete with corrections from previous submittal:
 - a. List of Materials.
 - b. Manufacturer's Product Data.
2. Field (installation) Drawings (these drawings shall not change devices or locations of devices without approval of the EOR – prior to bid the contractor shall notify the contract officer is any proposed changers to the design are to be suggested or changes to the design recommended): Collate in sequence:
 - a. Drawing Index/symbol sheet.
 - b. Floor plans. At scale of Contract Documents. Show:
 - (1) Devices with circuit number.
 - (2) Rough-in.
 - (3) Mounting height.
 - (4) Conduit size.
 - (5) Wire type.
 - (6) Wire fill.
 - c. Sections/Elevations. At scale of Contract Documents.
 - (1) Mounting location reference.
 - d. Enlarged Plans. At scale of Contract Documents or larger as required for trade coordination. Show:
 - (1) Refer to “floor plans”.
 - (2) Architectural features.
 - (3) Clearances.
 - e. System conduit riser drawing, show:

- (1) Terminal cabinets.
 - (2) Coordination with floor plans.
 - (3) Wire runs not shown on floor plans.
 - (4) Wire type.
 - (5) Wire fill.
 - f. Mounting details
 - (1) Seismic details as required if varying from those noted on the design documents.
 - g. Installation details as required.
 - (1) Terminal cabinets: terminations.
 - h. Wire run sheets (if used) Show:
 - (1) Wire Number.
 - (2) Source.
 - (3) Designation
 - (4) Signal Type.
 - (5) Wire type.
 - (6) Operating level or voltage (if applies).
3. Shop (Fabrication) Drawings: Collate In sequence:
- a. Drawing Index/symbol sheet (if separate set from Field Drawings).
 - b. System functional drawings. Submit separate drawing for each system/subsystem. Show:
 - (1) Equipment: Function, make, model.
 - (2) Wire number.
 - (3) Wire Type.

- c. Fabrication details submit for:
 - (1) Receptacles.
 - (2) Panels.
 - (3) Special mounting provisions.
 - (4) Legends/engraving details. Half or full size:
 - (a) Receptacles.
 - (b) Panels.
 - (c) Equipment.
- 4. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- 5. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- 6. Show annunciator layout, configurations, and terminations.
- I. Shop and Field Test Reports: Provide per CFC 901.2.1 provisions.
 - 1. Schedule: Submit test reports In timely manner relative to Project schedule such that owner may conduct Verification of submitted Test Data at owner's option, without delay of progress.
 - a. Shop test report: Submit prior to shipping completed system to project site.
 - b. Per CFC 901.2.1. Statement of compliance. Before requesting final approval of the installation, where required by the fire code official, the installing contractor shall furnish a written statement to the fire code official that the subject fire protection system has been installed in accordance with approved plans and has been tested in accordance with the manufacturer's specifications and the appropriate installation standard. Any deviations from the design standards shall be noted and copies of the approvals for such deviations shall be attached to the written statement.
 - 2. Test Reports: Include:

- a. Time and date of test.
 - b. Personnel conducting test.
 - c. Test Object.
 - d. Procedure used.
 - e. Test equipment, Including serial and date of calibration.
 - f. Results of test - numerical or graphical presentation.
- 3. Verification of Submitted Test Data: owner may elect to verify some or all test data submitted. Contractor to provide statement of compliance per CFC 901.2.1 as required when requesting final test. Retest In presence of designated observer(s) at reasonable convenience of owner. Provide technician familiar with work of this Section. Provide all test equipment.
- J. Reference Data for Operation, Maintenance and Repair
 - 1. In addition to the requirements of Division 1, submit one (1) additional set. Submit in three post binders (not ring binder) with Tabs.
 - 2. Index.
 - 3. Systems operating Instructions.
 - 4. Reduced set of system Record Drawings.
 - 5. Key schedule.
 - 6. Maintenance and spare parts schedules.
 - 7. Shop and Field Test Reports.
 - 8. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, Instruction and service manuals for each equipment item. For each set, provide manufacturer's original printed copies only. Photocopies not acceptable.
- K. Record Drawings in AutoCAD current format and pdfs.
 - 1. Quantity:
 - a. Review sets: as for Shop and Field Drawings.

b. Record set:

- (1) Two USB drives with applicable .DWG files and pdfs with all equipment data.

2. Content: All drawings required under “Field and Shop Drawings”. Show “as Installed” condition. As built to be signed by fire alarm installer and dated.

L. Other than Specified Equipment

1. Equipment other than specified shall be considered for approval provided the following is submitted in writing by the contractor to the Consultant ten (3) days before the bid date:
2. Complete lists, descriptions and drawings of materials to be used.
3. A complete list of current drain requirements during normal supervisory conditions, trouble conditions, and alarm conditions
4. Battery standby calculations showing total standby power needed to meet the system requirements as specified

M. Substituted Equipment:

1. If equipment other than that specified is supplied, it shall be the contractor's obligation to submit the appropriate documentation and allow the specifying Consultant sufficient time to consider the equality of the substituted items.

N. Satisfying the Entire Intent of these Specifications

1. It is the contractor's responsibility to meet the entire intent of these specifications. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the Consultant and owner's representative.
2. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the contractor.

1.07 GUARANTEE/WARRANTY

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials

required to correct any defect during this one year period shall be included in the submittal bid.

1.08 POST CONTRACT MAINTENANCE:

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the submittal, include a quote for a maintenance contract to provide all maintenance, test, and repair described below. Include also a quote of unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment, and response travel costs. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor that shall describe the protocol for preventive maintenance. The schedule shall include:
 - 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
 - 2. Each circuit in the fire alarm system shall be tested semiannually.
 - 3. Each smoke detector shall be tested in accordance with the requirements of CFC 907.8.B;907.8.4 CSFM & NFPA Standards.

1.09 POST CONTRACT EXPANSIONS:

- A. The contractor shall provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.
- B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable control modules equal (list actual quantity of each type).
- C. Quotation shall include installation and test labor and labor to reprogram the system for this 10% expansion. If additional FACP hardware would be required, include the material and labor necessary to install this hardware.

- D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include cost of conventional peripherals or the cost of initiating devices or Notification appliances connected to the addressable monitor/control modules.
- E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.10 APPLICABLE STANDARDS AND SPECIFICATIONS:

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards.
 - 1. DSA Requirements including all IR documents.
 - 2. County of Ventura Fire Code
 - 3. All requirements of the Authority Having Jurisdiction (AHJ).
 - 4. CFC
 - 5. NFPA Fire Code

1.11 APPROVALS

- A. The system shall have proper listing and/or approval from internationally recognized agencies.
- B. The system shall be listed by the international agencies as suitable for extinguishing release applications.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIAL

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the Fire Alarm Code.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

- C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.02 CONDUIT AND WIRE

A. Conduit:

1. Conduit shall be red & installed in accordance with the DSA & fire marshal requirements.
2. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.
4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4 inch (19.1 mm) minimum and red in color.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with DSA codes and approved by CSFM and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation.
 5. Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. The system shall support up to 1,000 ft. of untwisted, unshielded wire. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop.
 6. All field wiring shall be completely supervised.
 7. The Fire Alarm Control panel shall be capable of T-Tapping two wire type. Signaling Line Circuits (SLC's) Systems, which do not allow or have restrictions in, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.
 8. All wire/cable used in underground or below grade, applications shall be rated by the manufacturer for the intended use and be gel filled.
- C. Terminal Boxes, Junction Boxes and Cabinets:
1. All boxes and cabinets shall be DIN listed for their use and purpose.
- D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
- E. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 16 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.03 MAIN FIRE ALARM CONTROL PANEL

- A. The FACP shall be an FCI E3 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.
- B. System Capacity and General Operation:
1. The control panel shall provide, or be capable of expansion to 2000 intelligent/addressable devices.

2. The system shall include Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (Style Y) programmable Notification Appliance Circuits.
3. The system shall support programmable driven relays.
4. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
5. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
6. The FACP shall provide the following features:
 - a. Drift Compensation to extend detector accuracy over life.
 - b. Sensitivity Test
 - c. Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.
 - d. System Status Reports to display or printer.
 - e. Alarm Verification, with verification counters.
 - f. PAS presignal.
 - g. Rapid manual station reporting (under 2 seconds).
 - h. Non-Alarm points for general (non-fire) control.
 - i. Periodic Detector Test, conducted automatically by software.
 - j. Pre-alarm for advanced fire warning.
 - k. Cross Zoning with the capability of: counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
 - l. March time and temporal coding options.
 - m. Walk Test, with check for two detectors set to same address.

- n. Security Monitor Points.
- o. Control-By-Time for non-fire operations, with holiday schedules.
- p. Day/Night automatic adjustment of detector sensitivity.
- q. Device Blink Control for sleeping areas.

C. Central Microprocessor:

- 1. The Microprocessor shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
- 2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
- 3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. Display:

- 1. The display shall provide all the controls and indicators used by the system operator and may be used to program all system operational parameters.
- 2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
- 3. The display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE-ALARM.

4. The Display shall provide a key touch key-pad with control capability to command all system functions, entry of alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The Display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

E. Signaling Line Circuit (SLC):

1. The SLC interface shall provide power to and communicate with intelligent detectors (Ionization, Photoelectric, or Thermal) and intelligent modules (monitor or control). This shall be accomplished over a single SLC loop and shall be capable of Style 4 or Style 6 wiring.
2. The loop interface shall receive analog information from all intelligent detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall 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 shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet all local VDE and VdS requirements and be certified by VdS as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:

1. An EIA-232 interface between the Fire Alarm Control Panel and Listed Electronic Data Processing (EDP) peripherals shall be provided.
2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible computers.
3. The EIA-232 interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.

4. An EIA-485 interface shall be available for the serial connection of remote annunciators and LCD displays.
5. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.

G. Enclosures:

1. The control panel shall be housed in a DIN listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

H. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients, consistent with DIN standards.

I. An optional module shall be available which provides Form-C relays rated at 5.0. The relays shall track programmable software zones.

J. Power Supply:

1. Per CBC/CFC 907.6.2 the primary Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP and shall be a dedicated lock on breaker source.
2. It shall provide 5.0 amps of usable Notification appliance power, using a switching 24 VDC regulator. A 3.0 amp notification expansion power supply shall be available for the demanding requirements visual devices, for a total system capacity of 8 amps.
3. It shall provide a battery charger for 30 hours of standby using dual-rate charging techniques for fast battery recharge.
4. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. It shall be power-limited.
6. It shall provide optional meters to indicate battery voltage and charging current.

- K. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
1. Provide per CFC 604.2.4 on emergency power source with back up power.
 2. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 30 hour standby.
 3. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
 4. The FCPS shall include an attractive surface mount backbox.
 5. The Field Charging Power Supply shall include the ability to delay the AC fail delay requirements.
 6. The FCPS include power limited circuitry.
- L. Field Wiring Terminal Blocks:
1. For ease of service all panel I/O wiring terminal blocks shall be a removable, plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks, which are permanently fixed, are not acceptable.
- M. Operators Controls:
1. Acknowledge Switch:
 - a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and Trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
 - b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
 2. Signal Silence Switch: Activation of the Signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field

programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. System Reset Switch: The system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
 - a. Holding the system RESET switch shall perform a lamp test function.
4. Drill (Evacuate) Switch:
 - a. The drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

N. Field Programming:

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All programming may be accomplished through the standard FACP keypad.
3. All field defined programs shall be stored in non-volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.
5. Program edit shall not interfere with normal operation and fire protection. If a fire condition is detected during programming operation, the system shall exit programming and perform fire protection functions as programmed.
6. A special program check function shall be provided to detect common operator errors.
7. An Auto-Program (self-learn) function shall be provided to quickly install initial functions and make the system operational.

8. For flexibility, an off-line programming function, with batch upload/download, shall also be available.

O. Specific System Operations:

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the control panel. Sensitivity range shall be within the allowed window.
2. Alarm Verification: Each intelligent addressable smoke detector in the system shall be independently selected and enabled to be alarm verified. The alarm verification delay shall be programmable from 5 to 30 seconds. 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.
3. Point Disable: Any device in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Device status.
 - b. Device types.
 - c. Custom device labels.
 - d. View analog detector values.
 - e. Device zone assignments.
 - f. All program Parameters.
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing system status.
6. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that will be capable of storing up to 800 system alarms/troubles/operator actions. Each of these activation's will be stored and time and date stamped with the actual time of the activation. The contents of the History Buffer may be manually reviewed, one event at a time, or printed in its entirety.

- a. Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 800 system events.
 - b. The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
- 7. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each intelligent smoke detector and shall analyze the detector responses over a period of time.
 - a. If any intelligent smoke 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 detector will be annunciated on the system display, and printed on the optional 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. Pre-alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
- 9. Software Zones: The FACP shall provide 99 software zones. All addressable devices may be field programmed to be grouped into software zones for control activation and annunciation purposes.

2.04 SYSTEM COMPONENTS

A. Signaling Devices:

- 1. STROBES shall be UL 1979 listed (as required by Code):
 - a. Strobes shall be provided as required and indicated on the contract drawings and shall have a flash rate not to exceed 60 times per minute.
 - b. The word "Fire" shall appear on the lens or lens plate.
 - c. Strobes shall be a 15cd, 1Hz minimum for restrooms and 75cd, 1Hz for large rooms (i.e., library, multi-use, meeting, etc.).

- d. Strobes shall mount to 2 gang box, flush or surface as shown on drawings.
- 2. SPEAKERS (as required by Code & per CBC/CFC 907.5.2.2 & 907.5.2.2.2):
 - a. Alarm Speakers shall be provided as required and as indicated on the contract drawings.
 - b. Speakers shall mount to a 4 sq. box. for interior use and a cast weatherproof, gasketed box for exterior use.
 - c. Speakers shall be red in color.
 - d. Sound pressure level shall be 85dBA at 10 feet
 - e. Screw terminals shall be provided for field connections.
 - f. Unit may be configured with optional Strobe for interior Horn/Strobe applications.
- 3. SPEAKER/STROBES (as required by Code):
 - a. Speaker/Strobe combination units shall be supplied as required and as indicated on the contract drawings.
 - b. Strobes shall not to exceed 60 flashes per minute.
 - c. The word "Fire" shall appear on the lens or lens plate.
 - d. Strobes shall be a 15cd, 1Hz minimum restrooms and 75cd, 1Hz for large rooms (i.e., library, multi-use)
 - e. Wiring for Strobes shall be separate from Speaker Circuits. Strobes shall mount to face of Speaker unit.
 - f. Wiring for Speakers shall be separate from Strobe Circuits. Horns shall mount to a 4 sq. box. for interior use.
 - g. Speakers shall be red in color.
 - h. Sound pressure level shall be 85dBA at 10 feet
 - i. Screw terminals shall be provided for field connections.
- 4. MINI-SPEAKERS (as required by Code):

- a. Mini-Speaker units shall be supplied as required and as indicated on the contract drawings.
- b. Speakers shall mount to a single gang or double gang box for interior use.
- c. Mini-Speakers shall be red in color.
- d. Sound pressure level shall be 90dBA at 10 feet
- e. Screw terminals shall be provided for field connections.

B. Addressable Devices – General:

- 1. Addressable Devices shall provide an address-setting means using rotary decimal switches.
- 2. Addressable Devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches. Devices, which use a binary address setting method, such as a dip switch, are not an allowable substitute.
- 3. Detectors shall be intelligent and addressable, and shall connect with two wires to the Fire Alarm Control Panel Signaling Line Circuits.
- 4. Addressable smoke and thermal detectors shall provide dual alarm and power LEDs. Both LEDs shall flash 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 illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
- 5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
- 6. 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 DIN, VDE and/or VdS as meeting the calibrated sensitivity test requirements.

7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. An optional base shall be available with a built-in (local) sounder rated at 85 DBA minimum.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

C. Addressable Pull Box (manual station as required by Code):

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

D. Intelligent Photoelectric Smoke Detector where noted on plans and as required per 907.2.24.3:

1. The detectors 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.

E. Intelligent Thermal Detectors:

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

F. Intelligent Duct Smoke Detector:

1. The in-duct smoke detector housing shall accommodate an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed in the duct, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

G. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops, per NFPA Chapter 21 the emergency control functional interface (21.2.4) shall be located within 3 feet of sensor.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.

H. Two Wire Detector Monitor Module:

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

I. Addressable Control Module:

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

J. Waterflow Indicators: Not Applicable

1. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
2. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30 Å 45 seconds.
3. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve.

K. Sprinkler and Standpipe Valve Supervisory Switches: Not applicable

1. Each sprinkler system water supply control valve riser or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. Each Post Indicator Valve (PIV) or main gate valve shall be equipped with a supervisory switch.

3. Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The mechanism shall be contained in a weatherproof aluminum housing that shall provide a 3/4 inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. Switch housing to be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

L. LCD Alphanumeric Display Annunciator:

1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of forty (40) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. Up to 32 LCD annunciators may be connected to an EIA 485 interface. LCD annunciators shall not reduce the annunciation or point capacity of the system. Each LCD shall include vital system wide functions such as, System Acknowledge, Silence and Reset.
4. LCD display annunciators shall mimic the main control panel 80 character display and shall not require special programming.
5. The LCD annunciator shall have switches that may be programmed for System control such as, Global Acknowledge, Global Signal Silence and Global System Reset. These switch inputs shall be capable of being disabled permanently or by a key lockout function on the front plate.

2.05 BATTERIES:

- A. Shall be 12 volt, Gell-Cell type (two required) and per NFPA 72, 10.6.10.1.1 shall be noted 2025 Feb manufacturer date stamp.

- B. Battery shall have sufficient capacity to power the fire alarm system for not less than thirty hours (30) plus thirty minutes (30) of alarm upon a normal AC power failure.
- C. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in accordance with the VDE, DIN, EN, VdS Standards, along with local codes, as shown on the drawings, and as recommended by the equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. 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.
- C. 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.

PART 4 - GUARANTEE AND TEST

4.01 GENERAL

- A. The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for one year from the date of final acceptance by consultant.
- B. Acceptance shall consist of the following:
 - 1. Per CFC 901.2.1. Statement of compliance. Before requesting final approval of the installation, where required by the fire code official, the installing contractor shall furnish a written statement to the fire code official that the subject fire protection system has been installed in accordance with approved plans and has been tested in accordance with the manufacturer's specifications and the appropriate installation standard. Any deviations from the design standards shall be noted and copies of the approvals for such deviations shall be attached to the written statement.

2. Burn-in period.

- a. The system shall be accepted for start of warranty upon successful completion and testing of AHJ and Consultant.
- b. Burn-In period shall be a 30 day time frame to allow the system to operate free of defects, grounds, programming faults, etc.
- c. The 30 day Burn-In shall begin the day of acceptance by AHJ.
- d. The Burn-In period shall be 30 days of continuous use without system trouble, false alarm, open, short or ground condition present.
- e. Should the system fail for any reason during the burn-in period, the contractor shall respond immediately upon notification by owner's personnel and correct said deficiencies.
- f. Upon correction and restoration, the "Burn-In" period shall be re-set to "0" and the 30 day count shall begin again.
- g. Start of Warranty shall commence upon day 31 of successful "Burn-In" period.

4.02 FINAL TEST (as applicable for project devices)

- A. Per CFC 901.2.1. Statement of compliance. Before requesting final approval of the installation, where required by the fire code official, the installing contractor shall furnish a written statement to the fire code official that the subject fire protection system has been installed in accordance with approved plans and has been tested in accordance with the manufacturer's specifications and the appropriate installation standard. Any deviations from the design standards shall be noted and copies of the approvals for such deviations shall be attached to the written statement.
- B. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with VDE, VdS and DIN Standards.
- C. Part of burn in period to be done prior to final test complete items 1 thru 11.
 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 flow 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 should 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.
- D. Before the installation shall be considered completed and acceptable by the awarding authority, a test on the system shall be performed as follows:
1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, the inspector of record (IOR) and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.
 2. Audibility tests shall be performed utilizing a calibrated Decibel Meter. The system shall be capable of supplying 15dB over ambient noise levels. Tests shall be conducted in the presence of the Consultant and AHJ at selected locations by Consultant/AHJ. Prior to acceptance, testing the contractor shall have verified signal levels in each area as to meeting the above criteria.

3. Where application of heat would destroy any detector, it may be manually activated.
4. The initiation circuits 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.
5. When the testing has been completed to the satisfaction of both the contractor's job foreman and the representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the fire department.
6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance and successful burn in period.
7. Prior to final test, the fire department must be notified in accordance with local requirements.
8. Submit completed Certification form. The form shall be submitted in type written format. Hand written forms will not be accepted.

4.03 AS-BUILT DRAWINGS, TESTING, AND MAINTENANCE INSTRUCTIONS

- A. Per CFC 901.5.2; 901.6.2.1, a complete set of reproducible "as-built" drawings in AutoCAD R2015 format (CDs and sheets) 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 shall be delivered to the owner upon completion of system acceptance. Records to be retained a minimum of 5 years on premises per Title 19.
- 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. The owner shall be furnished with all programming disks for each installation as well as hard copy printouts. Provide necessary training and/or schooling to designated owner personnel at no additional cost to owner. Training shall be at the owner's designated location, by factory

trained personnel. Provide all necessary interconnection cables for remote programming via “laptop” computer.

C. Testing Frequency Instructions:

1. 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 complete 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.

D. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

1. Instruction on replacing any components of the system, including internal parts.
2. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions
3. A complete list of all equipment and components with information as to the address and phone number of both the manufacturer and local supplier of each item.
4. User operating instructions, shall be provided prominently displayed on a separate sheet located next to the control unit.
5. Administrative staff of the school shall be thoroughly instructed in the use of system by authorized distributor. Such service shall be provided in conjunction with the Fire Alarm equipment.
6. Staff of the Park as well as owner maintenance staff shall be thoroughly instructed in the use of the System. Training shall include a minimum of three (1) hour sessions, to be scheduled at the Owner’s designated time.
7. Maintenance instruction shall be performed in the same manner as described above. Training shall include a minimum of three (1) hour sessions, to be scheduled at the owner’s designated time.

END OF SECTION

BLANK PAGE

SECTION 27 1300

INTERCOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section Includes:
 - 1. Telecommunications Cabling at the new or remodeled buildings for the project. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
 - 2. The Horizontal (workstation) Cabling System shall consist of a minimum of two (2) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document.
 - 3. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.
 - 4. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.03 REGULATORY REFERENCES

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.
- B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6 component and channel compliant.

- D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
1. ANSI/TIA/EIA - 568-C.0, Generic Telecommunications Cabling for Customer Premises
 2. ANSI/TIA/EIA - 568-C.1, Commercial Building Telecommunications Cabling Standard.
 3. ANSI/TIA/EIA - 568-C.2, Balanced Twisted Pair Cabling Components, Addendum 1 –
 4. ANSI/TIA/EIA - 568-C.3, Optical Fiber Cabling Components
 5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998.
 6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002.
 7. ANSI/TIA/EIA – 607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, August, 1994.
 8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999.
 9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – 10th Edition, 2003.
 10. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –2002.
- E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.04 APPROVED CONTRACTOR

- A. The Telecommunications Contractor must be a Certified Installer for the products and/or system being supplied. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with said certification. At least (1) for every (3) members of the copper installation and termination crew must be certified to a Technician Level of training by the product manufacturer or BICSI. At least (1) for every (5) members of the optical fiber installation and termination crew must be certified by the product manufacturer or other approved organizations in Optical Fiber installation and termination practices.

1.05 WORK INCLUDED

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system.
- B. The work shall include, but not be limited to the following:

1. Furnish and install a complete telecommunications wiring infrastructure as described on the plans and in these specifications.
2. Furnish, install, and terminate all UTP and Optical Fiber cable.
3. Furnish and install all wall plates, jacks, patch panels, and patch cords.
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Perform link testing (100% of horizontal and/or backbone links) and certification of all components.
7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Adhere and comply with all requirements of the product certification programs.
9. Provide owner training and documentation. (Testing documentation and As-built drawings).

1.06 SUBMITTALS

- A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
 1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
 2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
 3. Submit appropriate cut sheets and samples for all products, hardware and cabling.
- C. Work shall not proceed without the Owner's approval of the submitted items.
- D. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

1.07 QUALITY ASSURANCE

- A. The telecommunications contractor shall staff the project with qualified personnel. All products shall be new and in good condition.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Delivery and receipt of products shall be at the site described in the Scope Section.
- B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage

location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

- C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

1.09 DRAWINGS

- A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
- B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

PART 2 - PRODUCTS

2.01 EQUIVALENT PRODUCTS

- A. The Owner and engineer have selected specific products that achieve the desired level of performance and preference. The project has been designed around said products. Proposed substitutions must demonstrate equivalent performance in all areas to the satisfaction of the Owner and must be submitted for review at least 10 days prior to bid. The Owner shall not be required to entertain substitutions submitted after bid.

2.02 WORK AREA OUTLETS

- A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.
- B. The Telecommunications Outlet Assembly shall accommodate:
 - 1. A minimum of two (2) modular jacks.
 - 2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary.
 - 3. A blank filler will be installed when extra ports are not used.
 - 4. All modular jacks shall have their circuit number on the faceplate identifier strip.
 - 5. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications

contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.

6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

C. Faceplates: The faceplates shall:

1. Be as appropriate to fit the modular jack used.
2. Be UL listed and CSA certified.
3. Be constructed of high impact, ABS plastic UL 94V-0 construction (except where noted otherwise).
4. Shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
5. Be compliant with the above requirements along with the following when incorporating optical fiber:
 - a. Be a low profile assembly,
 - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination,
 - c. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
 - d. Incorporate a shroud that protects the optical couplings from impact damage.
6. Be available as single-gang or dual-gang.
7. Provide easy access for adds, moves, and changes by front removal of jack modules.
8. Possess recessed designation windows to facilitate labeling and identification.
9. Include a clear plastic cover to protect labels in the designation window.
10. Have mounting screws located under recessed designation windows.
11. Comply with ANSI/TIA/EIA-606-A work area labeling standard.
12. Allow for the UTP modules to be inverted in place for termination purposes.
13. Be manufactured by an ISO 9001 registered company.
14. Manufacturer: Refer to parts list at the end of this section

D. Cat6 Data Jacks

1. Voice/Data jacks shall be 8-position modular jacks and shall be Category 6 performance as defined by the references in this document including ANSI/TIA/EIA-568-C.2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. The modular jack shall use dual reactance modular contact array.
3. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA-568-C.
4. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA-568-C Category 6 specifications.
5. The modular jack shall have low emission IDC contacts.
6. The modular jack shall use standard termination practice using 110 impact tool.
7. The modular jack shall be backwards compatible to Category 3, 5, and 5e.

8. The modular jack shall be center tuned to category 6 test specifications.
9. Dust covers shall be used on each termination.
10. Manufacturer: Refer to parts list at the end of this section

E. Cat 6a Data Jacks

1. Data jacks shall be 8-position modular jacks and shall be Category 6A performance as defined by the references in this document including ANSI/TIA/EIA-568-C.2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. Modular jack color shall match incoming cable plant.
3. The modular jack shall use dual reactance modular contact array.
4. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA-568-C.
5. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA-568-C Category 6A specifications.
6. The modular jack shall have low emission IDC contacts.
7. The modular jack shall use standard termination practice using 110 impact tool, or manufacturer approved method.
8. The modular jack shall be backwards compatible to Category 3, 5, 5e and 6.
9. The modular jack shall be center tuned to category 6A test specifications.
10. Dust covers shall be used on each termination.
11. Manufacturer: Refer to parts list at the end of this section

2.03 110 COPPER TERMINATION BLOCK

- A.** The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.
- B.** 110 Block Kits shall:
1. Include both the wiring block in a 50, 100 and 300 pair (as applicable) footprint and the connecting block.
 2. Be manufactured using fire retardant molded plastic.
 3. Support termination of 22-24 AWG solid conductor.
 4. Contain back openings for the feed through of cable.
 5. Meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory.
 6. Have color-coded tips on the wiring block and color-coding on the connector blocks for installation identification.
 7. Use standard termination practice requiring a single conductor 110 impact tool.
 8. Termination hardware shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
 9. Be backwards compatible to category 3, 5 and 5e.

10. Be labeled in compliance with ANSI/TIA/EIA-606-A labeling specifications using permanent labels and LabelMo software (or other labeling software/printer).
 11. Be manufactured by an ISO 9001 registered company.
- C. 110 Cross-Connect System Backboard Channels shall:
1. Be available in 300 and 900 pair sizes.
 2. Allow the mounting of 110 100-pair blocks without legs.
 3. Include bottom trough and grounding bar.
 4. Be wall mountable.
 5. Be of cold roll steel construction.
 6. Be manufactured by an ISO 9001 registered company.
- D. 110 Wall Mount Vertical Trough shall:
1. Be available in single channel or dual channel configurations.
 2. In dual channel configuration shall be used to provide separation for different wiring media.
 3. Be available in 300 pair and 900 pair sizes.
 4. Be wall mountable.
 5. Be used with wall mountable backboard channels. Acceptable configurations include a 300 pair and a 900 pair.
 6. Be of cold roll steel construction.
 7. Be manufactured by an ISO 9001 registered company.

2.04 MODULAR PATCH PANELS

- A. The Modular Patch Panels shall:
1. Meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory.
 2. Use low emission IDC contacts.
 3. Use dual reactance technology to enhance the signal-to-noise ratio.
 4. Require standard termination practices using a 110 impact tool.
 5. Use a single piece IDC housing designed to accept larger Category 6 conductors.
 6. Support both T568B and T568A wiring.
 7. Include easy to follow wiring labels.
 8. Include label fields.
 9. Allow for the use of icons.
 10. Include full length metal rear cable management.
 11. Be available in standard or high density.
 12. Be backward compatible to category 3, 5 and 5e.
 13. Be center tuned to category 6 test specifications.
 14. Manufacturer: Refer to parts list at the end of this section

2.05 RACKS

- A. All racks and wire management shall be of one manufacturer or designed specifically to work together. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal

cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.

B. Free-Standing Rack

1. Free-standing rack shall:
 - a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
 - 1) Rear channels to securely route distribution cables.
 - 2) Vertical management "cage" to protect patch cords while allowing easy access for moves, adds and change with individual 1-rack unit fingers and double hinged door.
 - 3) Include speednuts to reduce assembly time.
 - b. Have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
 - c. Have EIA hole pattern on front and rear.
 - d. Have rack units stamped on the front, on both sides allowing numbering from top-to-bottom or bottom-to-top.
 - e. Be available with a 10.5" or 16.25" channel depth.
 - f. Be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
 - g. Assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
 - h. Be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
 - i. Provide floor and ceiling access for cable management and distribution.
 - j. Provide pre-drilled base for floor attachment of rack.
 - k. Be available in a 7 foot version (45 rack units) or an 8 foot version (51 rack units).
 - l. Be available in standard color of black.
 - m. Be manufactured by an ISO 9001 registered company.
 - n. Manufacturer: Refer to parts list at the end of this section

2.06 HORIZONTAL DISTRIBUTION CABLE

- A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), 110 cross-connecting blocks (copper), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.
- B. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)
 1. Physical Characteristics:
 - a. The diameter of the insulated conductor shall be 0.044 in. maximum.
 - b. Shall consist of (4) twisted pairs.
 - c. Shall be suitable for the environment in which they are to be installed.
 - d. The color coding of pairs shall be in accordance with T-568B Wiring Scheme:

	Pair 1	Pair 2	Pair 3	Pair 4
	W-BL; BL	W-O; O	W-G; G	W-BR; BR
- e. The overall diameter of the cable shall be 0.320" nominal or less.
 - f. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
 - g. Cable shall withstand a bend radius of 1.3" at -20 degrees Celsius without jacket or insulation cracking.
 - h. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
- 2. Transmission Characteristics:
 - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
 - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 5.1 Nf.
 - c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
 - d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
 - 3. Cable shall be Berk-Tek LANmark-10G2 UTP, Berk-Tek LANmark XTP (for small-diameter applications) or approved equal.
 - 4. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark series category 6A (wet location) or approved equal.
 - 5. Cable installed in plenum spaces shall be plenum (FT6 flame rating) rated.
 - 6. Color of all CAT6A cable shall be blue.
 - 7. Manufacturer: Refer to parts list at the end of this section
 - 8. Cable installed underground/below slab in conduit shall be OSP (wet location)
- C. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)
- 1. Physical Characteristics:
 - a. The diameter of the insulated conductor shall be 0.044 in. maximum.
 - b. Shall consist of (4) twisted pairs.
 - c. Shall be suitable for the environment in which they are to be installed.
 - d. The color coding of pairs shall be in accordance with T-568B Wiring Scheme:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR
 - e. The overall diameter of the cable shall be 0.320" nominal or less.
 - f. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
 - g. Cable shall withstand a bend radius of 1.3" at -20 degrees Celsius without jacket or insulation cracking.
 - h. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
 - 2. Transmission Characteristics:
 - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
 - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 5.1 Nf.
 - c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
 - d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.

3. Manufacturer: Refer to parts list at the end of this section
4. Cable installed underground/below slab in conduit shall be OSP (wet location)
5. Cable installed in plenum spaces shall be plenum (FT6 flame rating) rated.

2.07 FIBER OPTIC CABLE

- A. Riser Indoor/Outdoor Optical Fiber Non-Conductive Loose Tube with Laser Enhanced 9/125um Optical Fibers
 1. Each Singlemode Fiber shall be:
 - a. Graded-index optical fiber wave-guide with nominal 9/125um-core/cladding diameter, OS2 or better industry rating.
 - b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-4920000.
 - c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
 - d. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455—204.
 - e. The measurements shall be performed at 23 degrees C +/- 5 degrees.
 - f. Maximum attenuation dB/Km @ 1310/1550 nm: 0.4/0.3.
 - g. Optical Fiber shall be laser optimized and guarantee performance throughput range of 1-Gigabit through 400-Gigabit Ethernet distances of >5000m for 1310nm.
 2. Physical Characteristics:
 - a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 - b. Shall be suitable for use in risers, and horizontal applications.
 - c. Shall have a dry water blocking system for cable core and buffer tubes.
 - d. Shall be available with a fiber strand count range from 6 to 72.
 - e. Shall have a 3.0 mm sub-unit diameter.
 - f. Shall have and be marked with an UL-OFNP and OFP FT6 Flame Rating.
 - g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.
 - h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
 - i. Suitable for underground or aboveground conduits.
 - j. Loose Tube fibers shall be color coded in accordance with EIA / TIA 598 with an overall yellow jacket.
 - k. Shall have a ripcord for overall jacket.
 - l. Suitable for operation between -40° to +75° C.
 - m. Shall be UV resistant.
 - n. Shall be of an all dielectric design.
 - o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.
 3. Manufacturer: Refer to parts list at the end of this section

2.08 FIBER OPTIC CONNECTORS

- A. LC Fiber Optic Connectors
 1. Each LC Fiber Connector shall:
 - a. Be a pre-polished fiber connector with a fiber stub or field-polish fiber connector.
 - b. Be available in single mode and multimode versions.

- c. Have a domed zirconia ferrule.
- d. Be a PC polish type connector.
- e. Accept a nominal fiber diameter of 125 micrometers.
- f. Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode.
- g. Have repairable tips.
- h. Have an insertion loss change of less than 0.2 dB after 500 reconnects.
- i. Be stable over an operating range of -40C to +75 degrees C.
- 2. Design Make:
 - a. Refer to parts list at the end of this section

2.09 COPPER CABLE PROTECTION UNITS

- A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point. Approved manufacturer of protection units is Porta Systems.

2.10 PATCH CORDS

- A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B for patch cord testing.
- B. Copper (UTP) patch cords shall:
 - 1. Use 8-position connector with impedance matched contacts and designed using dual reactance.
 - 2. Be constructed of 100 ohm, 4 pair stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 standard.
 - 3. Meet TIA category 6 component specifications in ANSI/TIA/EIA-568-B.2-1
 - 4. 100% factory tested to meet category 6 performance and
 - 5. ETL or any other nationally recognized 3rd party verification
 - 6. Be center tuned to category 6 performance specifications by using paired bi-level contact array.
 - 7. Be capable of universal T568A or T568B wiring schemes.
 - 8. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
 - 9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
 - 10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
 - 11. Have "snagless" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
 - 12. Be available in three standard colors.
 - 13. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
 - 14. Be backwards compatible to Category 3, 5 and 5e.
 - 15. Be manufactured by an ISO 9001 registered company.

- C. Optical Fiber patch cords shall:
 - 1. Contain two (2) multi-mode optical fibers.
 - 2. Use multi-mode, graded-index fibers with a 62.5 micron core.
 - 3. Be capable of transmission at both 850 nm and 1300 nm wavelengths.
 - 4. Include listing of actual loss of patchcord when packaged.
 - 5. Be manufactured in standard lengths of 1 m (3.27 ft), 2 m (6.56 ft), 3 m (9.84 ft), 4 m (13.11 ft), 7 m (22.95 ft), and 10 m (32.79 ft), and special ordered in any other lengths.
 - 6. Be manufactured by an ISO 9001 registered company.

2.11 GROUNDING AND BONDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.
- B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ungrounded conduits, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.12 FIRESTOP

- A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any

penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

PART 3 - EXECUTION

3.01 WORK AREA OUTLETS

- A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 12" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.0 document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable.
- E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.
- F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).
- G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.02 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

- A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

- C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.
- D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- E. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
- K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
- L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.
- O. Cables installed underground or below slab shall be suitable for use in wet locations and outdoors in duct or conduit. If wet location cable is exposed in the building after exiting the wet area, it must transition to an appropriate category dry cable within 50 feet (15M) of exiting conduit.

3.03 HORIZONTAL COPPER TERMINATION AND INSTALLATION

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C standard, manufacturer's recommendations and best industry practices.

- B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- E. The cable jacket shall be maintained as close as possible (within 25mm – 1 inch) to the termination point.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.04 OPTICAL FIBER TERMINATION HARDWARE

- A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.
- B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
- D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
- E. A maximum of 12 strands of fiber shall be spliced in each tray.
- F. All spare strands shall be installed into spare splice trays.

3.05 BACKBONE CABLE INSTALLATION

- A. Backbone cables shall be installed separately from horizontal distribution cables.
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits.
- D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.

- E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.06 RACKS

- A. Racks shall be securely attached to the concrete floor using a minimum 3/8" hardware or as required by local codes.
- B. Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.
- C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 9.0 of this document.
- D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- E. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.
- F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

3.07 FIRESTOP SYSTEM

- A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.08 GROUNDING SYSTEM

- A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.
- B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.09 IDENTIFICATION AND LABELING

- A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.
- B. Outside Plant cables passing through a pull box or vault shall have a cable label that is water and mud proof.
- C. All label printing will be machine generated by Ortronics LabelMo, or similar software, using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.10 TESTING AND ACCEPTANCE

- A. General
 - 1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
 - 2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Certification Program Information Manual provided by the product manufacturer and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
- B. Copper Link Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.
2. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance.
3. The basic tests required are:
 - a. Wire Map
 - b. Length
 - c. Attenuation
 - d. NEXT (Near end crosstalk)
 - e. Return Loss
 - f. ELFEXT Loss
 - g. Propagation Delay
 - h. Delay skew
 - i. PSNEXT (Power sum near-end crosstalk loss)
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss)
4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
6. Category 6 Performance Shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	69.0	64.0	65.3	62.3	21.0
4.0	4.0	67.0	62.5	53.2	50.2	21.0
10.0	6.3	60.6	46.0	45.3	42.3	21.0
20.0	9.0	55.6	51.0	39.2	36.2	21.0
31.25	11.3	52.4	47.7	35.4	32.4	19.1
62.5	16.4	47.4	42.6	29.3	26.3	16.1
100.0	21.2	43.9	39.1	25.3	22.3	14.0
155.0	26.6	40.7	35.8	21.4	18.4	12.1
200.0	31.5	38.8	33.9	19.2	16.2	11.0
250.0	36.0	37.1	32.4	17.3	14.3	10.0

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of an end-to-end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. **ONLY LINK TEST IS REQUIRED.** The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.11 SYSTEM DOCUMENTATION

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.12 TEST RESULTS

- A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used

for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

- B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.
- C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form CD-ROM). If needed, provide manufacturers software require to read the test results.
- D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 4 - WARRANTY AND SERVICES

4.01 WARRANTY

- A. The manufacturer shall provide the warranty directly to the end-user.
- B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for a minimum of 20 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.
- C. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.0. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 155Mb/sATM, and 1Gb/s ATM.
- D. The contractor shall provide a warranty on the physical installation.

4.02 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

- A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two-week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the product manufacturer, registering the installation.

END OF SECTION